



**NONPARAMETRIC ANALYSIS OF INFLATION TARGETING USING
PROPENSITY SCORE MATCHING APPROACHES**

Master's Thesis

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ABSTRACT

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This study employs the propensity score matching framework to examine the average treatment effect of inflation targeting approach to examine its economic performance on important economic variables. We use various nonparametric matching methods that have several advantages compared to the traditional regression models due to its properties that deal with potential bias problems. As a result of the evaluation framework, the results from the matching process are not flawed because of a self-selection bias. Moreover, the process does not need a specific functional form that may cause any omitted variable bias. Annual data for the period between 1990 and 2019 for different country groups are employed. Nearest-neighbor matching, propensity score matching, and kernel matching methods are utilized to examine the average treatment effect of inflation targeting framework on the inflation rate and inflation volatility, exchange rate stability, and foreign direct investment. Results document that the average treatment effects of inflation targeting on all outcome variables are statistically significant. The findings significantly document that inflation targeters perform better on the examined economic conditions compared to those non-inflation targeters to reach better macroeconomic conditions. To be more precise, the results of the propensity score matching analyses to examine the average treatment effect of inflation targeting conclude that if non-inflation targeting countries had adopted inflation targeting, their inflation rates, and inflation volatility would have been significantly lower, their exchange rate stability would have been significantly better, and their foreign direct investment inflows would have been significantly higher.

Keyword: Propensity score matching, Average treatment effect, Inflation targeting, Exchange rate, Foreign direct investment, Inflation

ÖZET

ENFLASYON HEDEFLEMESİNİN PARAMETRİK OLMAYAN EĞİLİM SKOR EŞLEŞTİRME YÖNTEMLERİ İLE ANALİZİ

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Bu çalışma, enflasyon hedeflemesi yaklaşımının ekonomik performansını önemli ekonomik değişkenler üzerindeki ortalama işlem etkisini incelemek için eğilim skoru eşleştirme yöntemini kullanır. Çalışma, yöntem olarak parametrik olmayan eğilim skoru eşleştirme teknikleri kullanarak geleneksel regresyon yöntemleriyle yapılan çalışmalarda sıklıkla ortaya çıkan sorunları da gidermeyi amaçlayarak farklılaşır. Yöntemin özelliğinden dolayı geleneksel modellerde sıklıkla karşılaşılan seçim yanlılığı sorunu ortaya çıkmaz. İkinci olarak, bu yöntem ile spesifik bir fonksiyonel forma ihtiyaç yoktur ve dolayısıyla sonuçlar ihmal edilmiş değişkenin yol açtığı yanlılıklardan etkilenmez. Son olarak, araç değişken kullanan alternatif modellere göre araç değişkeni seçiminden kaynaklanan hatalı tahmincilerin getirdiği eksikliklere de maruz kalınmaz. Analizlerde çeşitli ülke grupları için 1990-2019 dönemini kapsayan yıllık veriler yer almaktadır. Enflasyon hedeflemesi rejiminin enflasyon oranı ve enflasyon oynaklığı, döviz kuru istikrarı ve doğrudan yabancı yatırım girişleri üzerindeki ortalama işlem etkisini incelemek için en yakın komşu eşleştirme, eğilim skoru eşleştirme ve Kernel eşleştirme olmak üzere üç eşleştirme yöntemi ile analiz eder. Sonuçlar, enflasyon hedeflemesinin enflasyon oranı ve enflasyon oynaklığı, döviz kuru istikrarı ve doğrudan yabancı yatırım üzerindeki ortalama işlem etkisini istatistiksel olarak anlamlı olduğunu ortaya koyar. Bulgular, incelenen ekonomik göstergelerde enflasyon hedeflemesi uygulayan ekonomilerin enflasyon hedeflemesi uygulamayan ekonomilere kıyasla daha iyi makroekonomik koşullara ulaştığını gösterir. Daha kesin bir ifade ile, enflasyon hedeflemesinin parametrik olmayan eğilim skoru eşleştirme analizlerinin sonuçları, enflasyon hedefleme rejimini benimsemeyen ülkelerin eğer enflasyon hedeflemesini benimsemiş olsalardı enflasyon oranlarının ve enflasyon oynaklığının önemli ölçüde

düşüş göstereceğini, döviz kuru istikrarının ve doğrudan yabancı yatırım girişlerinin önemli ölçüde daha yüksek olacağı bulgusuna varır.

Anahtar Sözcükler: Eğilim skoru eşleştirme yöntemi, Ortalama işlem etkisi, Enflasyon hedeflemesi, Döviz kuru, Doğrudan yabancı yatırım, Enflasyon



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21.../09/2020

STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND RULES

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the references section; and that this study has been scanned for plagiarism with "scientific plagiarism detection program" used by Anadolu University, and that "it does not have any plagiarism" whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.


Gökhan Çelen Yılmaz

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LIST OF SYMBOLS AND ABBREVIATIONS

ATE	: Average Treatment Effect
Cab	: Current Account Balance as a share of GDP
CBRT	: Central Bank Republic of Turkey
CPI	: Consumer Price Index
Dif-in-difs	: Difference in differences
Exgs	: Exports of goods and services as a share of GDP
Energyuse	: Energy consumption kg of oil equivalent per capita
FDI	: Foreign Direct Investment
FPI	: Foreign Portfolio Investment
GDP	: Gross Domestic Product
Gdpcg	: Real GDP Per Capita Growth Rate
Gdpg	: Economic Growth
Gdpgv	: Volatility on economic growth
G7	: Group of Seven
Imgs	: Imports of goods and services as ashare of GDP
Loggdpc	: Logarithmic of real GDP per capita
Logpops	: Logarithmic of population size
OECD	: Organisation for Economic Co-operation and Development
PSM	: Propensity Score Matching
Rim	: Reserves in months of imports
REER	: Real Effective Exchange Rate
REERV	: Real Effective Exchange Rate Volatility
Topn	: Trade Openness
Unemp	: Unemployment rate
UK	: United Kingdom
USA	: United States
WDI	: World Development Indicator

1. INTRODUCTION

This study examines the economic performance of the inflation targeting regime, which targets price stability without using intermediate targets. The inflation targeting regime causes central banks to follow a much more transparent policy than the alternative regimes. An environment of transparent policy creates successful expectation management. Controllable expectation management ensures that the decisions of economic agents are shaped according to monetary policy decisions rather than past inflation. Although the inflation targeting regime is initially designed for developed countries, later on, this monetary policy framework encourages emerging markets as of the success of this regime in breaking the inflation inertia. After adopting the framework in New Zealand in 1989, an increasing number of countries have implemented the inflation targeting regime.

Country experiences show us that no country that implemented the inflation targeting regime has abandoned this approach and switched to an alternative monetary policy framework. After experiencing a global crisis such as the 2008 crisis, despite deviations from the inflation target observed in emerging market economies, they remained in this regime. The fact that thirty years have passed since the first implementation of this policy, and there are still new countries that start adopting, makes examining the effects of this approach more interesting on macroeconomic indicators.

Inflation targeting is a monetary policy implemented by the monetary authority to reach an inflation rate within a target or band range. The functioning of the regime is conditional on modeling the expected future inflation. Unlike other nominal anchor policies in inflation targeting, central banks have the independence to use different monetary policy tools in reaching the targeted inflation rates. This difference allows the country to focus only on its internal dynamics and consider all factors that can affect inflation, rather than a single variable of monetary policy. Among these factors, we can count the ones such as wage and exchange rate increases, and public pricing mechanism. Before the transition to inflation targeting, some preconditions should be established. Summarization of these prerequisites is as follows; ensuring the full independence of the Central Bank, price stability as the ultimate goal in monetary policy. However, the treasury sustains its domestic debt that is essential; the relationship between the exchange rate and inflation will weaken and reduced inflation. After determining the inflation

target, the Central Bank aims to eliminate the uncertainties in the economy that arises by inflation by announcing to the public how it reaches this target and what unexpected conditions deviate from the target.

The choice of inflation targeting regime for economies is a conditional nonrandom process. In other words, there occurs a self-selection problem to evaluate the success of inflation targeting policy. There are some conditions for self selectivity problems to arise. Countries' adoption dates differ from each other because of inflation targeting regime involves some preconditions. Therefore, countries have to complete some institutional requirements before adopting the regime. Secondly, the switching process of economies to inflation targeting is dependent on a historical process. Generally, countries begin to apply the inflation targeting framework following a crisis. With the employed propensity score matching methodology, this study investigates whether the achievement for inflation and its volatility, real exchange rate volatility, and foreign direct investment prove any considerable discrepancies between inflation targeters vs. non-inflation targeters.

The counterfactual assessment of inflation targeting comprises of three stages. First, estimated propensity scores calculate between inflation targeters and non-inflation targeters through probit regression. Probit estimation results show for each treatment and untreated units with similar characteristics. Calculated estimated propensity scores reveal the connection between variables and directions. In this way, covariates should be selected according to the following criteria: (i) variables should include some preconditions characteristic of inflation targeting; (ii) selected variables to drive outcomes; (iii) share similar characteristics for the treatment and control units. Second, the essential condition of matching techniques analyzes to control overlap between inflation targeters and non-inflation targeters. The common support graph decides the visual analysis of density distribution through the estimated propensity score in treatment and untreated units. The common support graph offers ideas regarding selected covariables, which satisfy the conditional independence assumption. The third step is to estimate the average treatment effect to assess the role of an inflation targeting regime. Three matching methods, namely nearest neighbor matching, propensity score matching, and kernel matching, are utilized to examine the average treatment effect of inflation targeting adoption on exchange rate stability, inflation rate and its volatility, and foreign direct investment inflow.

In the existing literature, economies that do not implement inflation targeting have a comprehensive sample while evaluating the role of the regime in a counterfactual way. However, since the implementation of the inflation targeting regime varies in each economy, the empirical result does not reveal an accurate assessment without examining the results within the sub-samples. The results reveal the situation that non-targeting countries would have faced if they had targeted them. A more in-depth analysis to question an effective policy design of the inflation-targeting regime for non-targeting countries requires considering the significance of different sub-samples for the analysis.

The first purpose of this study is to examine the effect of inflation targeting to reduce inflation rates and keep control of its volatility. In order for the results of the study to provide a broader perspective on the effectiveness of the policy, the study utilizes different matching techniques and compares them in different sample groups on inflation rates and its volatility. The reason is that, institutional characteristics of the economies and their unique macroeconomic situations affect lowering inflation rates and inflation volatility. Therefore, the whole sample at first evaluates the results for merging and developing, and developed economies. Then, the whole sample group is compared with how much the regime's impact change if the G7 country group is removed, which already has low inflation rates and high central bank independence prior to the transition to the regime. Another subsample group is Eurozone, which does not define themselves as inflation targeters. Therefore, in this study, the Euro area is evaluated as untreated units. They apply a particular monetary framework that implements within, excluding the states whose institutional framework and domestic dynamics are mutually dependent as a group, influencing the drop in the inflation rates and its volatility change. It follows, then, the whole sample is divided into different groups, namely, developed, and emerging and developing economies. Inflation targeting frameworks in developed economies occur implicitly, not explicitly, and also have sound macroeconomic conditions. Although the developed countries have similar characteristics within each other, there is a severe dynamic difference between the developing and emerging economies. Therefore, to make the results of the study more reliable, groups of OECD member economies are employed, which are employed socioeconomically similar to each other. All matching techniques for the overall and subsample document that inflation targeting is an effective policy design to inflation rates and its volatility.

The increasing transformation of economies into international trade with liberalization policies since the 1980s causes more pressure on exchange rates. The exchange rates are allowed for fluctuating in the inflation targeting regime. While the developing countries' economies fear fluctuations, on the other hand, the regime offers the opportunity to defend against shocks by using domestic dynamics. After the global crisis experienced in recent years, macroprudential policies occur to provide financial stability. The relationship of inflation targeting approach and the fluctuations in the exchange rate are investigated for the groups of the whole sample developing and emerging economies, high income. The sources of the exposure of developing and developed country groups are different from the fluctuations in exchange rates among each other. Moreover, while developed economies adopt a fully flexible floating exchange rate regime, the degree of regime flexibility in developing and emerging economies are smaller. For all these reasons, coefficient expectations for the impact of the inflation targeting framework on stabilization exchange rate volatility do not expect similarity between developed and emerging economies. Besides, matching results for high-income economies shows similar characteristics with the developed economies to get robust results compared to developing and emerging economies.

There is a positive correlation between the determinants of foreign direct investment and the regime's performance—the fact that the framework has a much stronger effect, especially in the developing and emerging economies. Also, inflation targeting creates a favorable environment for investments and thereby interesting to assess the influence of the inflation targeting regime on foreign direct investments. The economies subject to comparison are determined as developing and emerging economies and upper-middle income. The reason for choosing there two sample groups for comparison is that foreign direct investment inflow causes reserve accumulation without rising foreign debt burden. Second, with the movement of globalization, transfer resource shifts to developing countries. Since inflation targeting regime does not create different for developed economies in terms of institutional aspect, assessment of inflow of FDI for these economies do not contain for analyzes. Therefore, monetary policy drives force on foreign investments across groups of developing and emerging economies. Developing and emerging economies have heterogeneity in terms of political riskiness and fiscal position. Regarding the analysis of upper-middle income economies the results provide a robust analysis by reducing the different aspects of fiscal, unemployment, and monetary

situation. In this way, a more effective analysis is conducted for the significance of inflation targeting framework on foreign direct investment inflows.



CHAPTER ONE

1. EVOLUTION OF TARGETING STRATEGIES IN MONETARY POLICY AND AN OVERVIEW OF THE RELATED LITERATURE

1.1. The Emergence of Price Stability as the Main Goal

The primary goal of monetary policy is price stability for all policymakers and economists. Since the beginning of the 70s, the extraordinary evolution of monetary policy draws the framework of the inflation targeting strategy background, its place in monetary policy, and strategic requirements. Intellectual roots of inflation targeting as an operationally monetary policy consist of the price stability importance, time-inconsistency, and recognition costs of inflation.

The sight of the economy after the Great Depression, activist policies that endowed with Keynesian policy recommendations preponderantly consisted. Governments have always aimed to keep production and unemployment around their potential level via aggregate demand using activist fiscal policies (Mishkin, 1997; Woodford, 1999). On the other hand, another argument on which activist monetary policies believed that the Phillips curve has a long-term negative relationship between inflation and unemployment as a result of the study conducted by Samuelson. Indeed, macroeconomic stability was possible by affecting the aggregate demand until the '60s. In the meantime, trade-off policies among inflation and unemployment within the framework of the Phillips curve is valid. After the oil supply shock experienced in the early 1970s, the relationship of trade-off Phillips curve is not acceptable. The economy faces a phenomenon of stagflation, in which unemployment increases as inflation increases. This situation, which brings an economic cost that is difficult to compensate, causes new approaches in questioning Keynesian policies and conducting monetary policy.

The arguments are reasons of the Keynesian economic policy to collapse theoretically also constitute the theoretical developments of the occurrence of monetary policies over the long term as price stability. These are as follows (Bernanke et al., 1999):

- The macroeconomic effects of monetary policy have long and variable lags: Milton Friedman's monetarist critique.
- There is no long-run trade-off between inflation and unemployment in the long run.

- The problem of time inconsistency is essential for the effectiveness of the monetary policy.

The actualize of monetary policy's effects on the economy that have “long and variable lags” disrupts stability in macroeconomics and creates detrimental effects. The public and politicians only deal with the short term when evaluating policy practices and “cannot understand that policy lags may be very long and indeed may be longer than the time it takes for the problem to correct itself.” Likewise, monetary authorities tend to determine the actions according to the day (Friedman,1968). Friedman suggests that the impact of activist policies on the economy is adverse, so a steadily growing money supply policy rule satisfies economic stability. Since policymakers may be willing to solve the unemployment problem immediately through implementing expansionary monetary policies, but in this case, the invisible hand in the economy reveals unemployment to return to full employment until the policy takes effect. As a result, rising inflation leads to economic instability. Since academics accept that the Keynesian model is incompetent, the requirement alternative monetary policy occurs to search that based on price stability.

The second strong criticism is that the Phillips curve's trade-off concept between inflation and unemployment, which put forward by Milton Friedman and Edmund Phelps simultaneously unaware of each other, theoretically has been ineffectiveness in the long run (Phelps,1967; Friedman,1968). In practice, after the stagflation phenomenon observed in the 1970s reveal that there is no trade-off between inflation and employment. The theoretical invalidity of the long-run Phillips curve is related to ignores distinction in real and nominal wages. Friedman underlines that firms and workers are interested in real wages; therefore, their wages adjustments may change inflation expectations accordingly. As inflation rises, the expected inflation rate increases and results in the Phillips curve shifting upwards (Friedman,1968). According to Friedman and Phelps, there is a trade-off short term; however, in the long run, expected inflation increases and approaches the actual inflation rate; the Phillips curve becomes vertical. The fact that the Phillips curve is ineffective in the long run pushes the search for how to minimize the costs associated with production and employment while implementing anti-inflationary policies. The long-term inflationary influence of the Phillips curve reveals once again that the aim of monetary policies should be price stability.

The third reason Keynesian policy recommendations occur incredible because of the time-inconsistency problem in monetary policy. According to Kydland and Prescott

(1977) and Barro and Gordon (1981), economic actors have rational behavior and shape their expectations rationally. The fact that policymakers give up the previously announced program and display an inconsistent behavior. This situation leads to their loss of credibility. Because of all this, each monetary policy that aims price stability provides reliability in its targeting strategy.

Another reason for price stability to come to the fore is that after the energy shock experienced in the 1970s, economists, people, and politicians realize the costs of the high and persistent inflation to the economy. The environment of uncertainty created by inflation negatively affects firms' investment decisions, lowers economic efficiency, disrupts efficiency in resource allocation, negatively affects growth. Contrary to the high economic costs of high inflation, low and stable inflation creates a better economic environment by ensuring the efficient use of resource allocation in the market economy (Freedman and Laxton, 2009).

1.2. Targeting Strategies in Monetary Policy

After establishing a consensus about the contribution of a low level of inflation in the economy, economists question achieving this goal. These searches for the design and execution of monetary policy bring to the necessity of a nominal anchor in the implementation process (Bernanke et al.,1999; Fredman and Laxton, 2009; Mishkin, 1999).

Mishkin (1999) describes the nominal anchor as a constraint on the value of money. Bernanke et al. (1999) characterize the nominal anchor as a nominal variable used by the monetary authority to link the price level to a specific value for a certain period. The operation of the targeting strategy based on a nominal anchor implies that the central bank puts restrictions on some parameters: long-term inflation target, the permanence of inflation shocks, and the variability of shocks. With the restrictions on these variables, the aim is to bring inflation closer to its value (Jaeger, 2003).

The function of the nominal anchor is to help ensure price stability. It does by fixing the deflation expectations through the constraint imposed on the value of the national currency. Since its commitment to the anchor that keeps the nominal variable within a specific narrow range creates a direct and low inflation expectation, it creates the conditions for determining the price level required for price stability (Mishkin, 1999). The presence of low and stable inflation expectations results in stable price and wage-

setting behaviors, which reduces both inflation level and inflation volatility (Goodfried et al., 1999).

A functional nominal anchor prevents the problem of time inconsistency in monetary policies. Commitment to the anchor allows central banks to oppose the pressures of policymakers' short-term expansionary policies. Because the nominal anchor is the central point in which central banks can control themselves and take a reference for the expectations of the markets. Thus, it helps central banks to be more resilient against policies that are increasing production and employment in the short term but only creating inflation in the long term.

To sum up, the search for a strong nominal anchor arises because it is strengthened the relationship between the monetary authority's activities and the achievement of its goals. In the following section, the monetary and exchange rate targeting strategies are used as the nominal anchor form before the inflation targeting regime discusses.

Targeting strategies are a strategy that shows the way central banks will follow to achieve the ultimate goal of price stability. There are two reasons why targeting strategies are needed. The first reason is that monetary policy affects economic activities lagged. The second is that central banks do not have direct control power over the final target. This situation leads to the creation of a two-stage activity process in monetary policy. It refers to establishing the relationship between two-stage process instruments and final variables with the help of operational target and intermediate target variables. In other words, central banks put activity and intermediate targets between monetary policy instruments and final targets (Telatar, 2002). The design and implementation procedure of the monetary policy by the purpose of price stability is called the monetary policy implementation process.

The classification of monetary policy targets is as the operational or intermediate target variable. Planned targets are operational targets that central banks desired to reach in the short term. Central banks cannot directly affect the intermediate target variable by using policy tools. It uses the operational target variable to perform relatively direct manipulation to provide indirect control in the intermediate target variable. Changing this target, regardless of developments in the economy, indicates a change in monetary policy. Thus, these target variables function both as an indicator variable that can predict changes in the final objective variable, and an instrument variable used to influence them. In this

way, a direct chain of influence establishes with the instruments that can be directly controlled (Barth, 2002).

The intermediate variable refers to the nominal anchor, which is selected for the monetary policy. Targeting strategies are named based on the anchor (macroeconomic variable) based on their strategy. While monetary aggregate and exchange rate targeting is an intermediate targeting strategy, inflation targeting is an objective variable.

During the implementation, central banks take the form of a commitment to monetary policy to adhere to the targeting strategy. It causes the deviation of the intermediate target variable from the targeted policy to signal that the intermediate variable may deviate from the target. In the policy, it is necessary to arrange according to this signal. Keeping the intermediate target variable at the target value automatic ensures that the objective variables of the policy remain at the target values (Telatar, 2002).

In summary, in the targeting strategies consisting of two stages, the first step is to choose a variable that central banks can control and set a target. The ongoing process accompanies the ultimate goal that monetary policy aims to achieve.

1.3. Exchange Rate

One of the monetary policy strategies implemented to control inflation and inflationary expectations is the exchange rate targeting strategy. The history of the exchange rate targeting strategy goes back to the gold standard system, where the value of the national currency is attached to a precious metal such as gold.

Generally, the exchange rate targeting strategy implement in two ways. The first preferred method is to index the value of the domestic currency to the currency of a large country with a low rate of inflation or to partners, which is frequently traded. The second is a crawling peg letting the exchange rate fluctuate in a band range against a strong foreign currency (Mishkin,1999).

In the exchange rate as a nominal anchor, the prices of the commodity subject to foreign trade are conditional to the prices of the anchor countries. Thus, the effect of wage and price inertia on inflation, which cannot be traded, is expected to be broken in the process, and inflation expectations expect to bring inflation under control by approaching the anchor level in the country (Mishkin and Savastano, 2001).

The exchange rate-based stabilization program was accompanied by the changeover from high inflation to low inflation, compared to the industrialized countries of developing countries. The most important case for choosing the exchange rate as a nominal anchor by monetary authorities is that developing countries suffer from chronic inflation rather than high inflation. In countries where chronic inflation prevails, it is difficult to estimate the circulation rate of money. There is no clear separation between money and quasi-money. Therefore, it is uncertain how tight and steady the size will reveal in the face of any problem or shock. In exchange rate targeting strategy, unlike monetary aggregates, it is not necessary to have any exact information and stable relation about money demand and circulation. Another reason why the monetary authorities of developing countries prefer the exchange rate is that continuing inflation periods lead to a high degree of dollarization in the economy. The existence of high dollarization makes it challenging to control the money supply by policy authorities, affecting inflation and real activities. Therefore, a decrease in the domestic part of the money supply will have a low impact on total liquidity and inflation. Thirdly, the exchange rate sends more precise signals to the public about the intentions and actual movements of the currency than the money supply target. A nominal anchor with continuity and traceability allows the public to lower their inflationary expectations (Telatar, 2000).

The exchange rate targeting strategy, which is the preferred stabilization program for low inflation, has some advantages (Calvo and Mishkin, 2007; Houben, 2000; Mishkin, 1999; Mishkin and Savastano, 2001; Obstfeld and Rogoff, 1995).

- The strong commitment, which was the already announced exchange rate, composes the entity of a self-acting rule in terms of policymakers' monetary policy enforcement. The commitment of the exchange rate target obstructs policymakers from discretionary performing monetary policies. The monetary authority directs the exchange rate target by tracking the movements in the domestic currency. This objective of the exchange rate helps to eliminate the problem of time inconsistency in terms of monetary policy management.
- If the exchange rate of the country, which is preferred as an anchor, is reliable, the expectations of the people in the anchor country towards the inflation level will be based on the targeted country. This situation causes inflation inertia to be broken in countries with chronic inflation.

- Central banks with low reliability attach their national currencies with the money of central banks with high reliability. In this way, it is possible to import the anchor of the central banks, which are highly trustworthy. For example, it has been observed that many European countries have benefited from Bundesbank's credit by depositing their national currency on the German mark.
- The exchange rate-based stabilization program is a strategy that can be easily understood and followed by the public. This situation accompanies the transparency of the increasing monetary policy. The conducting monetary policy must be simple and clear enough to influence expectations.
- A stable exchange rate system ensures exchange rate uncertainty and transaction costs in international trade. Correcting currency fluctuations reduces uncertainty and stimulates foreign trade. Allowing the exchange rate to fluctuate freely causes instability in the economy.

Despite its current benefits, the problems faced by countries implementing the exchange rate regime can be listed as follows:

- In countries that are open to capital flows, there can be no independent monetary policy implementation of targeting countries. In other words, the central banks of the countries fixing the exchange rate cannot react independently to domestic shocks or developing events (Mishkin, 1999). The background of this argument is based on the impossible trilemma hypothesis, called the paradox of the open economy (Mundell, 1960). According to the impossible trilemma hypothesis, if the financial markets are becoming increasingly international transactions, the country has to give up either the exchange rate stability or the possibility of implementing an independent monetary policy. In this case, in a country that ties its national currency to another country, when there is a decrease in domestic demand, it cannot affect the demand by lowering interest rates. Monetary authorities remain as the viewer that production and inflation fall below or rise above the desired level. The anchor has to determine its monetary expansion strategy based on changes anchored by its monetary growth rate (Mishkin, 1998).
- On the other hand, countries implementing a fixed exchange rate regime exposes to any shock occurring in the anchor country, since a fluctuation in the interest rates in the country chosen as anchor affects the interest rates of the country implementing the strategy at the same level (Mishkin, 1999). Suppose the increasing rate of short-

term nominal policy interest rates of the anchored by the central bank, economies as anchor countries face a financial and macroeconomic shock and cause an increase in the exchange rate risk of the country (Frankel, 1999). Using the panel data of Claessens and Kose (2013), they analyzed the exchange rate crises between 1975-1997 in 24 emerging market economies. The authors conclude that this external shock from the anchored by country caused the exchange rate crisis to result in a 2-3% drop in output.

- In countries that adopt the exchange rate targeting strategy, the reliability of domestic currency is generally low. For this reason, companies and financial institutions mostly prefer borrowing instruments in foreign currency. This trend inevitably forms the basis of the financial security gap. Because when there is a speculative attack in the exchange rate, devaluation increases the debt burden of companies and institutions that borrow in foreign currency. If there is no simultaneous increase with the assets expressed in the national currency, the firms' balance sheets destroy and a decrease in net wealth will occur. As a result, investments and economic activities will decrease (Mishkin, 1999).

1.4. Monetary Aggregate

In practice, the introduction of monetary targeting is related to two reasons. The first factor is the inflation trend in many industrial countries in the early 1970s (Schmid, 1999). The second factor is the need for a new nominal anchor with the globally increasing inflation rates following the collapse of the Bretton Woods system and oil shocks (Houben, 2000). The implementation of exchange rate targeting is not an option for huge countries such as Japan, the USA, and country blocks such as the European Union. As these countries do not have a specific country that can function as a nominal anchor, they turned to another alternative, money targeting strategy (Mishkin, 1999). The first country to implement a money growth target was Germany in 1974. The countries that have implemented this strategy in history are Switzerland (1975), Canada (1975), UK (1976), France (1976), the Netherlands (1977), Spain (1978), Greece (1983), Italy (1984) and Portugal (1987). Monetary targeting implementation experiences of countries other than Germany and Switzerland have taken place as a failed performance in history

(Houben, 2000). The monetary targeting of Germany and Switzerland is different from other countries in operation, and they act as practical pioneers of inflation targeting.

Monetary aggregates generally consist of the sum of cash in circulation, demand, and time deposits. The theoretical foundations of controlling money supply using monetary aggregates are based on Milton Friedman's constant-rate money growth rule (Houban, 2000). Based on the quantity theory of money, this monetarist view states that inflation stems from the increased money supply. According to the quantity theory, the primary function of monetary policy should limit to adjusting the money supply increase consistent with the real growth rate (Bofinger, 2001). In the monetary targeting strategy, the monetary policy focuses on providing an appropriate growth rate for the selected monetary size. The targeted growth in monetary size is determined by estimating an inflation rate that is consistent with price stability, any fluctuations in the circulation rate of money, and real potential growth in the economy.

The key strong aspects of monetary aggregate targeting can be listed as follows: (Houben,2000; IMF,2005):

- It enables the central banks of countries that implement monetary targeting strategy to access data on monetary aggregates with a much shorter time lag than other data. This advantageous situation ensures that central banks have prior knowledge and behave accordingly regarding the course of inflation in the short term.
- The fact that monetary aggregates are a directly controllable nominal size for central banks constitutes the second strongest aspect of the inflation and exchange rate targeting strategy. Because inflation is not a variable that can be controlled in inflation targeting. In exchange rate targeting strategy, it cannot make independent changes according to internal dynamics. This ensures that monetary aggregates serve as a strong anchor for the expectations of economic agents.
- Another benefit is that central banks only provide the opportunity to estimate the trend value of real output annually, the circulation rate of money, and a limited number of variables such as the monetary base.
- It allows the monetary authority to choose an inflation target independently from other countries, as opposed to exchange rate targeting so that it can adjust the fluctuations and shocks to the level of output according to their internal economic dynamics. (Mishkin et al., 2001).

Mishkin associates targeting strategies based on monetary aggregates with three key elements:

- Monetary policy decision-making processes are based on information regarding monetary aggregates.
- To direct the inflationary expectations of the public and markets, targets regarding monetary aggregates should be declared.
- Accountability mechanisms should be created to prevent large and systematic deviations from monetary targets.

The fact that the monetary targeting strategy has these three elements allows the central bank to determine and implement it in the light of domestic evaluations. Data on monetary aggregates are published in very short periods, such as a few weeks. Thus, it provides an opportunity to instantly access information about whether the central bank has reached its target. It provides the opportunity to instantly send signals to the public and markets about monetary policy and the intentions of policymakers to reduce inflation. The signals, in one way, help stabilize inflation expectations and lower inflation rates. On the other hand, it puts the central bank under the obligation of accountability for the performance of policy practices, thereby preventing policy authorities from falling into the time-inconsistency trap.

The ability of monetary targeting strategy to reach these strengths and advantageous elements depends on the existence of a strong and reliable relationship between the target variable (inflation or nominal income) and the targeted monetary size. If the velocity of money is unstable, a weak relationship occurs between the targeted variables and the monetary size. Shocks of the money demand function become large and unpredictable as a result of the unstable circulation speed. Such instability weakens the relationship between monetary size, output, and inflation. This weak relationship causes the target monetary size to deviate significantly from the optimal policy in interest rates. Therefore, fluctuations occur in production, inflation, and interest rates (Mishkin et al., 2001). As a result of all this, monetary size cannot provide a sufficient and accurate flow of knowledge about the stance of monetary policy. Insufficient indication carries a weak guide on reducing inflation expectations and accountability for central bank practices (Mishkin, 1999).

The reasons for the failure of their monetary aggregates are related to the conceptual and real relationships that do not overlap. There are two main reasons why the relationship

between monetary aggregates and macroeconomic variables that central banks want to affect cannot be effective. The first one is financial innovations, which led to the birth of an unpredictable and unmeasurable demand for money. The second is that country experiences are very different from the rule of increasing the money supply proposed by Friedman, and the practices vary from country to country. In particular, the performance and experience disparity between monetary targeters that are Canada-the USA- the UK and Germany-Switzerland enable us to analyze the leading foundations of the inflation targeting strategy.

With the emergence of new financial markets and instruments arising from technological developments in payment systems and removing capital controls, unsteadiness comes off in money circulation. However, the claim for money and the control of the money supply get hard and incalculable. Since money-based stabilization leans on the predictability of money demand, its demand relationship weakened due to innovation in financial markets causes the correlation between the increment in money supply in the long term and the targeted macroeconomic variable.

It is observed that the monetary size is losing its effectiveness in monetary policy apart from financial markets, targeter countries do not apply rigid form. They even exhibit behaviors that allow the targets to be exceeded or not achieved. Common conclusions to be drawn from reference implementation processes of these behaviors of the USA, Canada, and the UK are (Mishkin, 2001): it is difficult to display the performance of monetary policy because of focusing more than one target; the targeted monetary aggregates are far from being followed seriously (frequently shifts are allowed); not declaring the targets within a regular schedule; serious policy measures are not taken to alleviate the increases in targeted monetary size; no compensation for missed targets has been made; even the monetary causes of these deviations are not disclosed. Naturally, in these countries, monetary aggregates have lost their ability to function as nominal anchors and to be a guide for transparency and accountability.

In light of all this information, monetary targeting was popularly used in the fight against inflation in the 1970s due to the mentioned advantages. However, in many countries implementing financial liberalization, this trend reverses when the unpredictable demand for money is combined with the loss of stability. The fact that the monetary size chosen as an intermediate target lost its nominal anchor position to control inflation has led economic units to alternative policy instruments.

1.5. Inflation Targeting

As discussed briefly before, countries search for a new monetary policy that arises consequences of the failure attempting exchange rate and monetary aggregate targeting to ensure reducing to low levels. As a result of these searches, there is a transition to the inflation targeting strategy, which is still popular today. In practice, the pioneer central bank on adoption to inflation targeting is Reserve Bank of New Zealand in 1990.

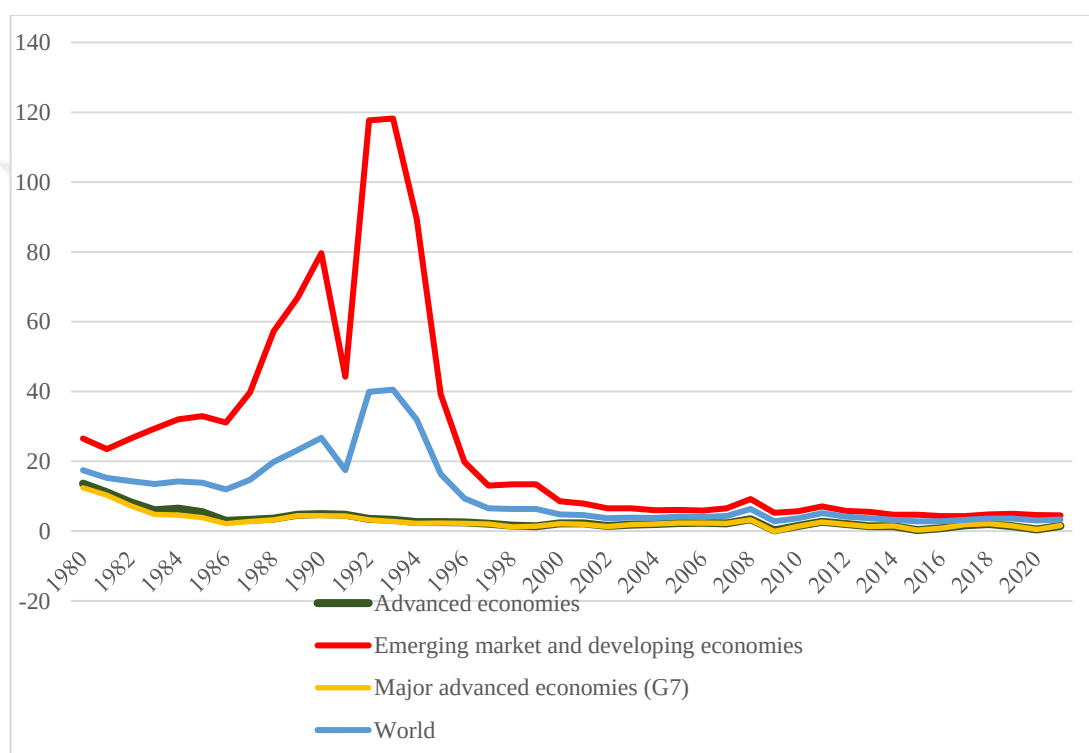


Figure 1.1: Inflation Rate, Average Consumer Price (Annual Percent Change)

Source: IMF, WEO 2020 [accessed 12.05.2020]

Note: The figure was prepared by the author

Since then, a gradually increasing number of developed and developing countries adopt at inflation targets because of the success of the implementation in terms of price stability and real enhancement economy. The graph shows that the course of global inflation has been drop fall the mid-90s with the targeting of the inflation regime. The rate of inflation has reached single-digit levels. Interestingly, in this chart, the developing inflation rate of developing countries to developed countries has been very close.

Today, most central banks utilize the inflation targeting regime to provide price stability at the conduct and evaluation of monetary policy. According to the IMF report

(2017), 40 country cases have anchored their monetary policy to an explicit inflation target.

The term inflation targeting for Bernanke and Mishkin (1997) is the public announcement of a formal quantitative or range of the target for the rate of inflation, to achieve it within a certain period, either through the government, the central bank, or both.

Inflation targeting definition for Batini and Laxton (2006) highlights the term of feature, which as an operational framework that directly takes the target itself as a variable without using any intermediate variables while achieving price stability.

Inflation targeting is also called "inflation forecast targeting" because, in this approach, monetary policy instruments are estimated based on expected inflation future inflation. This regime uses policy instruments to forecast the target variable, not to determine future inflation (Svensson,1997). The central bank's conditional inflation forecast while implementing inflation targeting employ as an intermediate target variable is called a formal intermediate target for monetary policy. Directly targets inflation itself imply without using any intermediate targets such as exchange rate or money growth rate (Bernanke and Mishkin,1997).

In broad terms, inflation targeting is a framework by a public announcement about a target which as of specified ranges for inflation rate; at the focused goal of price stability and central banks' commitment strongly to that; not consist of a rigid set of rules monetary policy.

1.5.1 Why Might Inflation Targeting Matter?

Before addressing the evaluation of the empirically economic performance or the sufficiency of inflation targeting, it would be helpful to consider why this regime makes a difference. Monetary policy under inflation targeting is operated by three dimensions- constraints, goals, and beliefs (Walsh,2009).

1)Constraints: Defines economic relations and sets limits on the achievable results of the central bank. Varieties form of Phillips Curve uses to analyze this policy constraint.

2)Objectives: Refers to the set of objectives that the central bank will set within the framework of the policy.

3)Beliefs: Represents the public beliefs about the direction and credibility of the monetary policy implemented by the Central Bank.

To simply define the influence of the inflation targeting behavior on constraints, the policy analysis utilizes a form of simple forward-looking Phillips curve:

$$\pi_{it} = \pi_{it}^T + \beta E_t(\pi_{t+1} - \pi_{t+1}^T) + \eta x_t + \varepsilon_t \quad (1.1)$$

Under an inflation-targeting regime, monetary authorities benefit this equation to provide the trade-off between inflation and output in the short term. In the equation, Walsh (2009) analysis as follows:

π refers to the inflation rate, π^T refers to the central bank's inflation target and x shows the output gap. ε represents cost shocks. π_{it}^T represents the current period account of the public, shaped according to the inflation target of the central bank. Some ways of influencing the inflation targeting mechanism in the forward-looking Phillips curve for households, firms, and central banks are as follows:

The first way, with explicit target concerning inflation shapes current, and future expectations of firms, households, and financial market participants since the announcement of the central bank's inflation target ensure that markets are informed in advance. This situation causes the asymmetric information problem to decrease. Through the result of this, these expectations can move harmony with the realized target rate of inflation on the central bank. The ability of the regime to influence expectations reduces harmful economic activities that low inflation can create so that expectation of the regime's success affect variables not only directly but indirectly.

The second way, the fact that the market has precise information about inflation instead of acting by predicting its inflation target causes the variability to decrease. For example, when there is a positive inflation shock in the economy, the central bank can make some adjustments between the output gap and inflation. The stability at inflation expectations would not alter the beliefs of the public according to this short-term adjustments to reduce inflation. Since false expectations will not be realized under inflation targeting, policymakers expect of more effective monetary policy tool and following decreasing volatility course inflation and the output gap.

To sum up, to achieve a low and stable inflation level under this framework should characterize with three components; the objectives of the central bank, public beliefs, weight constraints between inflation and output. These dimensions are an effective policy tool to reduce inflation uncertainty and change public expectations about inflation. Directly influence of inflation target on inflation expectations provides the indirect effect

to stabilize the economic environment. Thus, when the announcement target rate is understandable, the transmission mechanism has a more strengthful influence on households, firms, and financial market participants' decisions as a monetary policy tool. Theoretically, these analyzes are believed to be the power of the regime empirically to influence not only directly (inflation dynamics) but indirectly macroeconomic variables

1.5.2. Main characteristics of inflation targeting

The implementation methods of inflation targeting, the adoption process of countries to this framework, their infrastructure, the results of inflation targeting has discrepancy according to the characteristics of the countries. Despite all these differences, it has some features that make the target strategy different from other regimes.

Inflation targeting is a framework consisting of key five elements as monetary policy (Gemayel et al.,2011; Hammond,2012; Heenan et al.; Mishkin, 2004; Svensson,1998).

1) The quantitative target for inflation should be explicit which means the public announcement for the inflation target.

2) Central Banks should promise to price stability as the main objective of monetary policy but also not to ignore other sub-goals at the same time.

3) The policy decisions and analyses use comprehensive information including many variables, and not just money supply and the exchange rate.

4) Central Bank's attitude should have higher transparency on policy strategy and implementation through communication tools with the households, firms, and financial market participants about the plans, objectives, and decisions of the monetary authorities and higher central banks' accountability to stabilize its inflation objectives.

5)An operating procedure has on a forward-looking appraisal of inflation pressures, considering a broader layout of information.

Mishkin (2004) stands out that the inflation targeting strategy does not only consist of the public announcement of the numerical target of inflation for the ahead year. Especially emerging markets should harbor together the other four elements over-medium term for sustainable inflation targeting.

There is a strong relationship between the reliability of Central Banks and the success of monetary policies. Unlike alternative regimes, inflation targeting has an operational functioning that plays an essential role in establishing trustworthiness. This operational workplace creates a mechanism by which central banks can be held responsible for their actions in their monetary policy decisions.

In the inflation targeting regime, an expected inflation rate is calculated for one or more years. As it can be understood from its definition in the inflation targeting regime, it is necessary to announce a determined numerical target or range publicly. The situation in which central banks make a firm commitment is the announced inflation target. Having a single numerical target of the central bank indicates that price stability is based on this strategy and gives weight. At the same time, a previously announced numerical inflation target is; it helps authorities to understand their intentions to maintain and maintain price stability (IMF, 2005). This also ensures that the decision-making process sits on an institutional basis. The institutionalization of the decision-making process includes the following characteristics (CBRT, 2006).

- a) Policy decisions consisting of a transparent structure
- b) Determining the dates on which decisions will be made within a certain calendar
- c) Explanation of the reasons for the decisions
- d) Including a statement that determines the direction of future decisions

The harmonization of decision making processes with the existence of the institutional framework is important for some problems that may be encountered in the functioning of the regime. It may take place at the expected inflation rate at the end of the year away from the target. In this case, they have to write and publish an explanatory report on why inflation has moved away from the targeted level. Through the transparency and accountability provided by this information flow that changes annually or once in two years, it enables the public to understand the results of monetary policy developments. Thus, there is an increase in the reliability of the central banks in the public and economic units. The fact that the reports given by inflation targeting strengthen the feeling of confidence reduces the uncertainty about the course of future inflation. Likewise, increased confidence owing to the effective communication policy takes the control the inflation inertia (inflation bias) in an audited manner, and strong expectation management is formed. Also, sharing its forecasts for future inflation to economic units

presents another rate of inflation (future inflation) that people can refer to, other than past inflation, under the inflation targeting regime (Heenan,2006; Mishkin,2006).

Especially on the other hand, evaluating the performance of inflation targeting according to future inflation has brought expectation management to the fore, unlike other regimes. The ability of central banks to manage inflation expectations accompanies the bank's reputation through the principle of transparency and accountability. The positive impact of the expectation is of great importance on households and investors. Because the policy instruments of the high reputation of the central bank have an impact on macroeconomic variables, constitute a well-functioning monetary transmission mechanism. In this regime, central banks can affect market rates and asset prices by using short-term rates. Monetary policy should be transparent and predictable, as long-term interest rates reflect expectations for the short-term interest rates announced by the central bank. Besides, the expectations of the private sector affect pricing behavior and, thus, inflation rates (Svensson, 2010). For these reasons, it is essential to effectively manage the expectations of the private sector in terms of the monetary policy transfer mechanism.

The principle of transparency in its practices in monetary policy has brought along the practice of making monetary policy decisions on previously announced dates unless extraordinary situations occur. Today, almost all of the central banks implementing the inflation targeting regime are scheduled in advance. Many times a year the central bank will make a new monetary policy decision. Under the principle of accountability, the central bank makes these decisions or technical reports; Communicates with the public by making press conferences, presentations, congresses. Thus, the effectiveness of inflation targeting is strengthened by facilitating public understanding of the process and enabling it to participate in the policy process (Heenan,2006).

The main purpose of the inflation targeting regime is much more than the public announcement of a numerical inflation targeting set in the medium term. Unlike other regimes, the inflation targeting regime maintains a firm commitment to achieving price stability. It refers to the central bank's operational independence. Providing this condition is very important in terms of transparency. The inflation targeting strategy requires a high degree of transparency and accountability in monetary policy implementation. It is also worth noting that an independent central bank has more effective and higher reliability than politicians on financial markets and attaining low inflation.

Past experiences of countries like Turkey, Argentina, and Brazil that behaved under a strict monetary policy of alternative other policy regimes have shown to have a high risk for the global economy and financial environment (Truman, 2003). Under the inflation targeting regime, on the contrary strategies, reaction function has been modeled to reduce the unpredictable supply and demand shocks, including the flexibility to create a rigid maneuver area for the central banks, considering the real results of the economy in the short and medium-term.

Bernanke characterizes the flexibility feature of the inflation targeting regime with the concept of constrained discretionary (Bernanke, 1997). While the constraint represents the inflation target, the discretion conveys to the scope of considering the short-term economic and financial issues when conducting monetary policy (Truman, 2003). The concept of constrained discretionary coincides with the behavior of the central bank to use basic policy instruments free. In the process of monetary policy implementation flexibly, central banks can adjust basic policy instruments in line with the inflation target value. By changing short-term interest rates, there is an opportunity to defend against unexpected shocks and focus on domestic dynamics. In this way, central banks get the existence of a maneuver area where they can act discretely, considering the changes in employment and exchange rates.

Central banks benefit from the loss function that includes output gap, as well as inflation and fluctuations in production, not ignored (Svensson, 1998). Svensson (2001) describes the functioning of the loss function in the modeling of inflation targeting. The primary aim of monetary policy in the long term is to achieve price stability. However, at the same time, it attaches importance to following the cyclical fluctuations and, therefore, the policies that can keep the movements of the output around the potential level. The promise of central banks includes a strong and reliable commitment to stabilize inflation in the long run (Mishkin, 2001). Thus, it also has the flexibility provided to the central bank to follow stable policies that can keep economic growth at its potential in the short term. In other words, a weight ratio is provided that ensures cyclical fluctuations and thus, the movements of the product around the potential product are stable (Svensson, 2001). The weight given is a macroeconomic variable representing the rate of resource utilization to ensure central bank real stability. The aim is to keep the output gap equal to which difference between the potential output and the actual output is hidden or openly in balance. In addition to price stability, the strategy is implemented flexibly, taking into

account inflation targeting countries for other purposes. Briefly, one of the differences brought about by the flexibility of the regime is to continue targeting the inflation level while not ignoring the goals such as production stability, job creation, and financial stability.

1.5.3. Benefits of inflation targeting

When we compare the inflation targeting regime with other alternative monetary policies in the economic literature, it is possible to list the points where it is more advantageous as follows.

The fact that inflation targeting has an information-based strategic feature makes it a more systematic and rational monetary policy than other monetary policy strategies. Under the inflation targeting regime, monetary authorities are provided with the opportunity to access all the necessary information to achieve price stability (Mishkin and Savastano, 2001).

Using the central bank's inflation targets as an intermediate target ensures that monetary policy can be easily monitored and understood by economic units. This situation can be considered as a simplifying factor for monetary authorities to provide reliability (Svensson, 1997).

For monetary policy to be effective, intermediate targets must be measurable and controllable (McCallum, 1990). The fact that inflation forecasts are observable by the central bank increases the transparency of the intermediate target. Through transparency, the central bank can provide effective communication with the public (Svensson, 1997).

Unlike the fixed exchange rate regime, the central bank can react to short-term shocks in inflation targeting (Hammond, 2012; Mishkin, 2000; Mishkin and Savastano, 2001). In this way, it succeeds in minimizing the effects of shocks abroad on the policy to be applied. Because of the fixed exchange rate regime, there is a need for a balance between domestic interest rates and foreign interest rates. When a tight monetary policy is applied to combat inflation, domestic interest rates may exceed foreign interest rates. This mobility in capital inflows creates pressure on the change of exchange rate. Failure to respond to external shocks according to domestic dynamics may be very economically costly, such as large-scale reserve losses, high inflation, and financial crisis. The argument is concretized in the shown by targeter countries that have responded to the shock happen aggressively by increasing the interest rates due to the increase in

commodity prices between 2007 and 2008. While the annual change inflation in inflation-targeting countries is 8 percent, it is seen that the countries implementing the alternative regime achieve a much higher result, such as 14 (Habermeier et al., 2009).

Unlike the exchange rate and monetary aggregates, there is a strong correlation between the inflation targeting strategy target variable and the objective variable (Svensson,1997).

In the inflation targeting regime, the accountability mechanism sets up if the central bank explicitly undertakes inflation targets and cannot be achieved. Thus, mechanisms need to be established in this strategy to enable the central bank to be responsible. The establishment of these mechanisms helps the central bank to overcome the problem of time inconsistency, as it has to be bound by its commitments (Mishkin,2000).

In countries that adopt the inflation targeting strategy, it is much more responsible for monetary authorities to announce the target of inflation to the public beforehand. Since giving importance to the essence of liability and clearness entails the purpose that the policies implemented be understandable, observable, and predictable. For this, economic units and participants: (1) the objectives and limitations of monetary policy; (2) the numerical value of the inflation target and how the value is determined; (3) how to achieve the inflation target under current economic conditions; (4) be informed about the causes of deviations in the inflation target (Mishkin,1999).

1.5.4. Drawbacks of inflation targeting

Despite the many contributions that the inflation targeting regime has provided, it also has disadvantages. It is possible to list them as follows: " Inflation targeting is too soft, too hard or will not work" (Truman, 2003).

First, there are criticisms that the role of inflation targeting is not sufficient for the anchor of inflationary expectations. The primary basis of the commentary is the view that the inflation targeting regime has the flexibility to behave according to many situations while carrying out monetary policy. This problem, in specifically, creates uncertainty about when and how to return to targeted inflation when the central bank changes its leave target in case it deviates from the aimed at inflation (Batini and Laxton,2006).

Contrary to the previous review, there are opinions that inflation targeting enforces too much strict policy and hence stress to reduce economic expansion. The convincing effect of the inflation targeting regime on economic agents depends on the central bank's

continuous reach of targeted inflation. Forcing the central bank to reach the purpose in such a limited way can create a needless drop in development (Batini and Laxton,2006).

These two drawbacks cannot be considered as a severe disadvantage when we consider inflation targeting as a monetary policy form of constrained discretionary, as preferred today central banks. However, inflation targeting still encounters serious problems in terms of countries for the fulfilling regime.

The first of major shortcomings of these, especially in economies where inflation is high, forecasting errors regarding the course of inflation can be large. Predictive errors bring along the problem of not being able to meet the targets. In this case, the problem of losing trust, which is very substantial for the inflation targeting regime, arises, and there are inconveniences in guidance inflation (Mishkin,1999).

Another problem encountered in attaining price stability in targeting countries is that the inflation targeting regime is insufficient to ensure fiscal discipline or prevent financial dominance. If there is a high budget deficit, there is an economic structure that cares less about inflation (Batini and Laxton,2006; Mishkin,2000).

Inflation rates are not a directly controllable variable. Apart from monetary policy instruments, the fact that inflation is affected by myriad variables makes it difficult to evaluate policy decisions such as developments in commodity prices, nominal wages, consumer taxes (Houben,2000). The pricing behavior of the economy and the targeting horizon of inflation do not act simultaneously. The targeted rate should be able to predict the likely trend that prices will follow. Because the fact that pricing behaviors are affected by the decisions and agreements made in the past, causes inflation not to be controlled and the internalization problem of inflation is encountered.

After the 2008 global crisis, all targeting countries and policymakers has fronted the new and unexpected issue for inflation targeting regime. It has shaken belief obviously that a low and stable inflation environment is an assurance of financial steadiness. Central banks have made gradual changes to strengthen the financial system by developing new macro-policy policies without leaving the inflation targeting framework (Hammond, 2012).

1.6 Preconditions of Inflation Targeting

In the previous sections are mentioned regarding the definition of the inflation targeting and the official features that distinguish it from other regimes in economic literature. Nevertheless, this information will be incomplete for inflation targeting in terms of implementation (Amato and Gerlach, 2002). The structure of the institute should affiliate some key components that the inflation targeting strategy enables for achieving high success less challenging. It would be a false point of view to think that all of the conditions mentioned in this section has been before adopting inflation targeting process for countries. Batini and Laxton (2006), in their study on central banks of 21 inflation-targeting countries, examines how the inflation targeting is formulated, implemented, and communicated before and during the inflation targeting of central banks. The results of the research found that the necessary institutional, technical, and economic prerequisites are not required during the transition period of inflation targeting countries. For the success and achievement of inflation targeting, what is important is based on the adherence of the authorities' promises on maintaining structural change in the ongoing process after inflation is targeted. In other words (Amato and Gerlach, 2002; Svensson, 2010), country experiences show that an effective inflation targeting should make the best effort to achieve these conditions and direct their goals to cover these conditions. In the literature, there are no standardized items for all the prerequisites that inflation targeting should meet. There are, of course, more structural sub-headings that are interrelated and to be realized. However, this section will focus primarily on the requirements that will increase institutional capacity, not the economic structure.

Price Stability: In the inflation targeting regime, the ultimate goal of central banks is to ensure that inflation is at a level close to its target level, and it wishes to maintain it consistently. Under this strategy, the central bank commitment to price stability (Khan, 2003). Monetary authorities have not engagement to another nominal variable, such as wages, nominal exchange rates, or employment level, avoids contradictions that may arise in policy implementation.

Sound Fiscal Policy: Fiscal policies are in discipline to functionalize the independence of the central bank, which is a prerequisite for the monetary policy to be regulated independently from other policies, especially the fiscal policy. Disciplined fiscal policies are situations in which there is no fiscal dominance. Fiscal dominance

occurs where budget deficits are not financed by borrowing (Khan,2003). With the introduction of legislation restricting the central bank's ability to lend to cover public deficits, the aim is to prevent direct financing of government deficits (Amato and Gerlach, 2002). As long as monetary authorities fail to provide budget discipline, they face monetization of public debts (Sargent and Wallace,1981).

Institutional Independence: Independence of the central bank is divided into two categories as objective and instrument independence. Under the inflation targeting regime in terms of objective independence, the aim is to achieve independence and price stability. Instrumental independence, on the other hand, expresses that the central bank, whose ultimate goal is price stability, can freely determine the monetary policy instruments to be carried out in line with this target. The fact that the central bank has instrument independence has essential points in terms of controlling the inflation targeting regime and the effectiveness of economic activities. Instrument independence provides an economic structure without pressure on the monetary policy that fiscal policy will create. Otherwise, the role of the central bank in financing the budget deficit in the dominant fiscal regime creates difficulty in controlling inflation.

Healthy Financial System: The existence of a financial system with low vulnerability against shocks is essential not only for inflation targeting but also for all other monetary policy strategies (Debelle,1997). If the health and development of the financial system are not good, the problems it may cause are essential for the inflation targeting regime. In a corrupt and underdeveloped financial structure, the economy can face three problems (Dabla-Norris et al.,2007). The first is that the presence of financial crises accompanies increased public debt, and the problem of financial dominance arises. Latter; causes failure of the transmission mechanism. In other words, there are problems in transferring monetary policy decisions to the real economy. The last one is: it is the lack of a liquid and significant foreign exchange market to operate the exchange rate regime properly. If the financial system in an economy is not strong enough, financial institutions frequently need a large amount of liquidity from the central bank.

Similarly, if the markets where economic units can manage the exchange rate risks are not developed sufficiently, they will trigger concerns regarding balance sheet-based vulnerabilities in terms of economy. Economies with balance sheet vulnerabilities prevent central banks from displaying a flexible behavior towards increasing interest rates

(Debelle,1997). While it is technically possible to withdraw liquidity from the financial system, there will be some difficulties, such as the loss of inflationary expectations in this regard, which will hinder its credibility by preventing the central bank from reaching its final target (Truman,2003).

Well developed technical infrastructure: One of the most essential features that distinguish the inflation targeting regime from other reduction of inflation policies is the adoption of forward-looking approaches. The central bank sets inflation targets and policies prospectively to reduce uncertainties. The fact that policy targets are based on inflation forecasts necessitates advanced econometric models to be used in inflation forecasts. The monetary policy decision-making process begins with the inflation forecast at the end of a particular time. These require that the forecasts contain realistic information about future inflation to be accurate and reliable. Only the econometric models are not used on the creation of models used by the central bank to predict the future course of inflation. The results of the model regarding expectation surveys, the expectations of central bank experts, and members of the monetary policy committee are designed to include. Because this vital role played by the models for the prediction of inflation is especially important in understanding the inflationary pressures in the economy correctly and the central bank's response to these pressures (Carare et al., 2002.)

1.7 Related Research on the Effect of Inflation Targeting

There is a vast literature on the effects of inflation targeting on economic performance in the academic literature after the implementation of the inflation targeting strategy in New Zealand. One of the most curious questions of the literature is comparing the achievement of inflation targeters to non-targeters. Various approaches of this research question arise in terms of several econometric approaches, sub-country samples, and economic effects. While most studies reveal that inflation targeting has not strong impact on developed economies, analyzes find strong evidence that inflation targeting is effective for developing and emerging economies. The consequence of the report has conclusive that the inflation targeting regime with a high rate of reducing on average inflation. Most of the studies obtain different results according to the sample groups, econometric techniques, date adoption of inflation targeting (full-fledged or soft inflation targeting).

1.7.1. Inflation rate and inflation volatility

The pure dif-in-dif method is the first applied (Cecchetti and Ehrman, 2000; Neuman and Von Hagen, 2002) regarding the evaluation of inflation targeting and its effect on inflation and output compared with alternative other regimes and non-inflation targeting countries. Studies suffer from the problem of endogeneity because they ignore as initial conditional effects of the transition to inflation targeting.

Ball and Sheridan (2003) considers a methodological discussion. Their research is the first study to try to figure out the "treatment of regression to the mean" problem by extension initial terms as an explanatory variable. Although the sample period and countries have quite parallel to Neumann and von Hagen (2002), they discover different effects concerning the inflation targeting performance. Ball and Sheridan (2003) concludes that inflation targeting regime has not further significant contribution to better economic outcome, unlike the result of Neumann and von Hagen (2002), the first inflation level clarifies the mainly reducing level of inflation. After reexamining the impact of inflation targeting in the study on developed economies, Ball (2010) reaches dropping rates of inflation but its impacts are very small.

Gonçalves-Salles (2008) and Batini-Laxton (2006) are some of the early studies in the literature to view the performance of inflation targeting emerging economies. They find that even after the mean reversion is under control, the regime's influence continues to a falling rate of inflation more in the treated countries through applying the same method.

Brito and Bysted (2010) use the dynamic panel estimator method to evaluate the role of inflation target, unlike the dif-in-difs method of Batini-Laxton (2006) and Gonçalves-Salles (2008). They obtain similar findings with Batini and Laxton (2007), Gonçalves-Salles (2008), Lin-Ye (2009) upon the rate of volatility disinflation.

Samarina et al. (2013) stress that the economic development level of countries plays a crucial part in the success of inflation targeting in their study consisting of 25 advanced and 59 emerging-developing countries in the period between 1985 and 2011. With the estimation analysis in dif-in-difs and PSM method, through of inflation targeting regime, they get to an outcome yield on the decrease in the proportion of inflation on the emerging and developing economies while on the developed economies, which change of monetary policy framework does not any matter. These findings contribute to the literature similar to previous results. However, Gonçalves and Salles (2008), Batini, and Laxton (2006) do

not consider the choice of adoption date according to full-fledged or soft inflation targeting.

Previous findings on reducing rate and volatility of inflation and output in dif-in-difs and panel estimator method have a problem with an arbitrary selection of countries. To overcome the bias problem, Vega and Winkelried (2004), Lin and Ye (2007,2009), and de Mendonça and Souza (2012) evaluate targeting effects by applying the propensity score matching method. The authors' strong argument that inflation targeting is a successful regime to reach disinflation and its volatility in emerging and developing economies. Although Lin and Ye (2007) and de Mendonça and de Guimereas Souza (2012) obtain that inflation targeting does not lead to drop significant impacts on inflation and its volatility in advanced countries, Vega and Winkelried (2004) claim that inflation targeting has not to discard benefits in terms of reducing inflation in both industrial and developing countries.

Hosny (2017) analyzes the success of inflation targeting in reducing inflation rates by using various econometric techniques that are OLS, panel, PSM, and quantile treatment effect approach on both developed and emerging-developing samples. Results of all specification corroborate with existing literature of the regime's effectiveness in achieving low inflation rates. Mishkin (2000) claims that the high inflation rates act negatively with probability adoption of the inflation target, but empirical findings of Hosny (2017) indicate the opposite evidence. To achieve this result, Hosny (2017) benefit via a method of quantile treatment effect. The results of that method show that if a country has high inflation rates before moving to inflation targeting, the regime is more effective in reducing inflation rates. That is, the theoretical necessity of low inflation rates for the transition to the regime claimed by Mishkin has been empirically rejected. Interesting evidence is the most significant contribution to the literature.

1.7.2 Real exchange rate volatility

Lin (2010) ask from a perspective not previously covered whether countries that implementation of inflation targeting any alteration external economic variables. This research strongly asserts that considering in developing countries, inflation targeting regime is a good monetary policy strategy in providing nominal and real exchange rate stability and higher international reserves, but opposite results in industrial economies. Ebeke and Fouejieu (2015) add a supplementary relationship between adopted inflation

targeting regime and degree of exchange rate regime instead of *de facto* nominal exchange rate variability. Under an inflation targeting framework, countries in emerging markets may be prone to a more flexible exchange rate regime than non-inflation targeting emerging counterparts. The study of Soe and Kakinaka(2018) enhances the research question by including the study of Lin (2010), investigation upon useful effect of inflation targeting in terms of external economy, the relevance between the inflation targeting regime and the exchange rate pressure. Results indicate that country groups in developing, under an inflation targeting framework have lower volatility in exchange market pressure and international reserves, and also policy stances would not be prone to the foreign exchange market intervention. Remarkable detail in the results of the study shows that this useful inflation targeting effect is not successful in low-income countries.

1.7.3 Foreign direct investment inflow

Tapsoba (2012) is the first study to investigate whether the inflation targeting regime has an appealing impact aspect of foreign direct investment on the economies of developing countries. As a result of that study, there is concluded that the economies which conduct the inflation targeting regime as a monetary policy have a positive effect on FDI with the advantage of the driving force of the domestic macroeconomic and institutional framework. Although Ambaw and Sim (2018) has a similar period and sample, research claims that the inflation targeting regime has neither an increase nor a decrease in its effect on FDI compared to the fixed exchange rate regime. The difference in the findings between the two studies, Ambaw and Sim (2018) employ more control variables that are institutional and internal factors such as rate of school enrollment, percentage of government expenditure, mobile subscriptions, broad money growth(%), taxes (% revenue) to evaluate relatively effect. The number of samples and time of Vasileva (2018) has addressed much wider than the range in Tapsoba (2012) and Ambaw and Sim (2018) study. The result of Vasileva (2018) supports the regime's success on foreign direct investments, like the study of Tapsoba (2012). This study adds to the literature that the emerging inflation targeting countries' economies do not suffer from the decreasing rate of FDI in bad times, and in good times the movement of FDI is not a significant effect regardless of monetary policy regime. Boughrara and Dridi (2017) evaluate the PSM approach to unveil the consequences of the implementation of inflation targeting framework in emerging countries on FPI and its volatility or not in the period

between 1986-2010. These works attain a significant increment of foreign portfolio inflows under the inflation targeting regime, but there is no sufficient evidence for its volatility.

Table 1.1 Literature Survey

Study	Countries	Number of countries (number of inflation targeting countries)	Period	Method	Result
Cecchetti and Ehrmann (2000)	Industrial/ Developing	23(9)	1985-1997	Difference-in-differences	Negative*
Neumann and Von Hagen (2002)	Advanced	9(6)	1978-2001	Difference-in-differences	Negative*
Ball and Sheridan (2003)	Advanced	20(7)	1985-2001	Difference-in-differences	No effect*
Vega and Winkelried (2004)	Advanced/Emerging	109(23)	1990-2004	Propensity score matching	Negative*
Batini and Laxton (2006)	Emerging	44(13)	1985-2004	Difference in differences	Negative*
Lin and Ye (2007)	Advanced	22(7)	1985-1999	Propensity score matching	No effect*
Gonçalves and Salles (2008)	Emerging	36(13)	1980-2005	Difference-in-differences	Negative*
Lin and Ye (2009)	Emerging	52(13)	1985-2004	Propensity score matching	Negative*
Ball (2010)	Advanced	20(9)	1985-2007	Difference-in-differences	Very small effect*
Brito and Bystedt (2010)	Emerging	46(13)	1980-2006	Dynamic panel model	Negative*
Lin (2010)	Developing/ Industrial	74(23)	1985-2007	Propensity score matching	Positive (for developing) Negative (for industrial) - stability on the real exchange rate
de Mendonça and de Guimarães e Souza (2012)	Advanced/ Developing	180(29)	1990–2007	Propensity score matching	No effect (for advanced), negative (for developing)*

Table 1.1 (Continued) Literature Survey

Tapsoba (2012)	Developing	53(20)	1980-2007	Propensity score matching	Positive-foreign direct investment
Samarina et al. (2013)	Advanced/emerging, developing	84(29)	1985-2011	Difference in differences, propensity score matching	No effect (for advanced), negative (for developing, emerging)
Boughrara and Dridi (2017)	Emerging	38(13)	1986-2010	Propensity score matching	Positive-foreign portfolio investment
Hosny (2017)	Developing/developed	170(?)	1990-2011	OLS, panel, propensity score matching, the quantile treatment effect	Negative-inflation rates * If when begin to transition initial inflation rate has high, the effectiveness of inflation targeting is more
Ambaw and Sim (2018)	Developing	46(?)	1990-2006	Propensity score matching, difference in differences	No effect-foreign direct investment
Iuliia Vasileva (2018)	Developing countries	71(16)	1985-2013	Difference in differences	Positive effect-foreign direct investment
Soe and Kakinaka (2018)	Developing	101(16)	1990-2014	Propensity score matching	Negative-exchange market pressure
Notes: * refers to the adoption of inflation targeting effect on rate and volatility of inflation. Negative means inflation targeting effect on reducing rates and volatility of inflation.					

CHAPTER 2

2. METHODOLOGY AND DATA

2.1. Methodology

The applied methodology makes a difference by employing the matching framework with several advantages compared to the traditional linear regression models due to its properties that deal with the potential bias problems. First, because of the randomization structure of the counterfactual evaluation framework, the results from the matching process are not flawed because of a self-selection bias. Second, the matching process does not need a specific functional form that may cause the omitted variable bias. Third, the propensity score matching method does not suffer from extrapolation beyond the common support. Fourth, as it is a nonparametric approach, it does not require a monotonic transformation. Last, compared to the alternative parametric models that require an instrumental variable, this approach has the advantage of not suffering from the problem of choosing instruments that have the potential to give flawed estimates. (Baycan, 2016)

Therefore, the propensity score matching approach (PSM) offers distinct superiority compared to other econometric methods that examine the influence of inflation targeting on economic policy. PSM can be applied to many countries and also enables us to the targeting effects in more detail for understanding the effects on broad variables through systemic empirical correlation.

After the chronic inflation problem in the world, the inflation targeting framework performed success and encouraged other countries that have not adopted. However, in order to decide on the transition to this period, comparing the average economic performance of the countries applying inflation targeting with the average of the economic performances of the countries that do not adopt this policy will not provide an accurate assessment. The period of transition for countries to the regime is not random and without reason. In practice, some of the countries implement this regime after a period of crisis, and some apply a transition period that is first implicit and then explicit. The reason is that their economic characteristics and institutional infrastructures are effective in choosing the regime. The selection mechanism that regulates the relevant treatment group is based on a non-random process. The propensity score matching method is

utilized to solve self-selection bias observed in linear econometric techniques (Lin and Ye, 2007 and 2009).

2.2. Average Treatment Effect

The propensity score matching methods are employed to evaluate the impact of inflation targeting regime of counterfactual treatment effects (Rosenbaum and Rubin, 1983). The propensity score matching method is an effective approach in resolving the biased results in studies that cannot be observed in studies.

These consist of two sample categories: treatment and control group. The treatment group refers to the countries that adopted an inflation targeting regime and the control group refers to the countries that did not adopt the inflation targeting policy. The related treatment effect can be explained mathematically as follows:

$$ATT = (Y_{i1} | D_i = 1) - E(Y_{i0} | D_i = 1) \quad (2.1)$$

D_i is a targeting dummy indicator that shows whether the unit is treated or not. If a country is inflation targeters, the value unit takes 1, and 0 otherwise. Y_{i1} denotes the observation outcome value, after a country implemented an inflation targeting regime. Y_{i0} refers variable if i country had not adopted an inflation targeting regime. $Y_i = Y_{0i} + D_i(Y_{i1} - Y_{i0})$ is the actual observed result of unit i. In this case, the average treatment effect on the treated ones is expressed as follows:

$$ATT = E(Y_{it}(1) - Y_{it}(0) | D_i = 1) = E(Y_{it}(1) | D_i = 1) - E(Y_{it}(0) | D_i = 1) \quad (2.2)$$

In 2.3 equation, while $E(Y_{it}(1) | D_i = 1)$ refers to the observable variable, $E(Y_{it}(0) | D_i = 1)$ is an unobservable variable. In other words, $E(Y_{it}(0) | D_i = 1)$ implies a counterfactual situation that shows the result when treated units are not treated. $E(Y_{it}(1) | D_i = 1) - E(Y_{it}(0) | D_i = 0)$ shows the value as a result of the counterfactual situation. This statement denotes the performance difference between units treated from non-observable data and units not treated. The average treatment effect (ATE) on the treated unit shows the difference between the result obtained after the treatment and the possible result that the unit would have achieved if it had never been treated. In other words, average treatment effects (ATE) present the different economic performance of the country between pre and after the adoption of inflation targeting regime. Moreover,

ATE offer the possible economic consequences if the same country had not switched to that particular regime.

Since $E(Y_{it}(0)|D_i=1)$ will not replace the outcome of the treatment result $E(Y_{it}(0)|D_i=0)$, there will be a difference between the control and treatment group. The results of the treatment units on inflation targeters and non-inflation targeters will not reveal a biased result only when the sample group is randomly assigned to the treatment. In practice, choosing of implementation of inflation targeting is not a random choice. The economic performance and institutional characteristics of countries affect the countries' starting to target inflation. In short, determining the implementation process of the countries to inflation targeting is dependent according to some conditions. Also, results affect the outcome, which occurs a bias problem. Heckman et al. (1998) mathematically signify the selection bias as follows:

$$B(X) = E(Y_{i0} | D_i = 1, X) - E(Y_{i0} | D_i = 0, X) \quad (2.3)$$

The self-selection bias defined in equation 2.4 would be zero if the inflation targeters and non-inflation targeting groups have similar observable and non-observable features. In this study, the propensity score matching method utilizes to evaluate the treatment effect of inflation targeting.

As the number of observed covariates increases, there occurs of the dimensionality problem because of matching characteristics. Matched unites are conditional to evaluate a single variable vector or weighting variables. Therefore, an increased number of covariates lead to difficult estimation for ATE. If treated and control units matches each other according to propensity score, high dimensionality problem copes with (Rosenbaum and Rubin, 1983).

2.3. Propensity Score Matching

Matching on propensity score is a technique proposed by Rosenbaum and Rubin (1983) to eliminate the self-selectivity problem when assessing the average treatment effect. The approach suggests that when the units in the treatment group and the control group have the same probability of treatment, the units in these two groups will have similar characteristics. According to Rosenbaum and Rubin (1983), counterfactual analysis is consistent under the following assumptions.

- Conditional Independence Assumption

The conditional independence assumption assumes that the selection has fully completable with observable variables. Its mathematical is as follows:

$$(Y_1, Y_0) \perp D | X \quad (2.4)$$

$\perp$ refers to independence. According to this assumption, there is a set X of observable common variables. The unit's assignment for processing occurs randomly and conditionally to X means that the possible outcomes in the out-of-process scenario as independent of the treatment state. Thus, two format the control variables are an unbiased counterfactual group for the treatment group. The conditional independence assumption includes both that affect the inflation targeting decision of X and the outcome variables of inflation rate and its volatility, real effective exchange rate and inflow of foreign direct investment.

- Common Support Assumption

Common support is also called the overlap condition assumption. According to the assumption, the probability of being both treated and untreated/control units to the process for each X value is between 0 and 1. This assumption is mathematically expressed as follows:

$$0 < P(D=1|X) < 1 \quad (2.5)$$

The probabilities of X which are treated and control variables will always take a positive value. This will ensure that the properties of the treated and untreated units match with each other and confirm a perfect match.

Under the assumptions of conditional independence and common support, the propensity score matching method for ATT estimator could be rewritten as:

$$ATT_{PSM} = E[Y_{1t} - Y_{0t} | T_{it} = 1, p(X)] = E[E[Y_{1t} | T_{it} = 1, p(X)] - E[Y_{0t} | T_{it} = 0, p(X)] | T_{it} = 1] \quad (2.6)$$

According to this expression, the PSM estimator shows the difference between the average of the treatment and control units in the same propensity score range, based on the respective outcome variable.

2.4.1. Estimation of propensity scores

The propensity score matching model described above is conditional on propensity scores estimated through probit or logit regression. The definition of the dependent

variable is as a dummy variable in which the treatment units have a value of 1, and the untreated units have a value of 0.

According to Rosenbaum and Rubin (1983), propensity scores for unit i are defined as follows:

$i = 1, \dots, N$ to be, observed covariates vector according to X_i , the control group ($z_i = 0$) counterfactual treatment group ($z_i = 1$) conditional probability of matched.

$$e(x_i) = pr(z_i = 1 | x_i) \quad (2.7)$$

According to the equation above given z_i for independent of X_i assumption is defined as follows:

$$pr(z_1, \dots, z_n | x_1, \dots, x_n) = \prod_{i=1}^N e(x_i)^{z_i} \{1 - e(x_i)\}^{1-z_i} \quad (2.8)$$

Matchings that are over propensity scores show the tendency to balance the distributions of common variables in the control and treatment groups. Any functions of matching and covariates based on propensity scores also balance X . In other words, it reduces the heterogeneity between the control and treatment groups and brings units closer together. As a result, if control and treat units have the same propensity score, it is possible to match (Rosenbaum and Rubin, 1985).

2.4.2. Nearest-neighbor matching estimation technique

In this method, treatment and control units are ordered randomly. Then, the treatment units are matched with the control unit (one-to-one match) or units (one-to-many matches) that have the closest propensity score. Increasing the number of neighbors offer an advantage, which is lower variance. The nearest neighbor matching method deals with this discarded units. Feature of nearest-neighbor matching searches for control units with the nearest propensity score to those of each treated unit.

C_i is the set of the counterfactual units for each treated individual i with a propensity score. This uses the distance between observed variables to find similar individuals as in equation 2.9

$$C(i) = \min_j \|p_i - p_j\| \quad (2.9)$$

Measurement average treatment effect is as follows:

$$T^m = \frac{1}{N^T} \sum_{i \in T} Y_i^T - \frac{1}{N^T} \sum_{j \in C} w_j Y_j^C \quad (2.10)$$

where $w_j = \sum_i w_{ij}$ represents the weights.

2.4.3. Kernel matching estimation technique

Kernel Matching employs a weighted average with comparing the result of each treatment unit and with the untreated of the results of being matched. Kernel matching has an advantage with the lower variance since it contains more information. Weights depend on the distance between each treatment and control group. When estimated, Kernel matching selects the kernel function and the bandwidth parameter. Then the average takes higher weight on groups close in terms of the propensity score of a treated individual and lower weight on more remote observations. The estimated intercept offers an estimate of the counterfactual mean.

In the case of some poor, the kernel matching technique provides using all possible control units in the study. Also, a critical difference in this matching is that dependent weights closest to the treatment unit are given with the highest weights.

2.5 Data and Outcome Variables

Much of the existing literature is interested in inflation dynamics under the inflation targeting framework compared to the exchange rate or monetary targeting. Empirical literature recently pays attention to the effect of inflation targeting on other variables. The study focuses specifically on three outcome variables to assess the performance of inflation targeting policy; real effective exchange rate fluctuations, foreign direct investments and inflation rate and its volatility. While the inflation rate reflects internal economic dynamics of inflation targeting regimes, the exchange rate and foreign direct investment indicate the external effects of it. Data variables are drawn from the World Development Indicator (WDI) of the World Bank. The number of observations changes from one regression to another, depending on data availability for control variables and control groups. We analyze the effects of inflation targeting on macroeconomic indicators

compared to the countries that did not adopt inflation targeting by employing a variety of propensity score matching methods.

Research on macroeconomic effects of inflation targeting in general demonstrate that inflation targeting has stronger beneficial evidence countries in emerging, but developed countries improve in terms of economic performance is small. Previous studies do not take into account the substantial heterogeneity in non-inflation targeting countries. Since the economic conditions change in each economy, results may not directly affect monetary policy regimes. Bernanke and Woodford (2005) assert that some countries do not have good institutional quality. There is an inconsistency of macroeconomic fundamentals in such countries, and thereby, the implementation of inflation targeting regime becomes difficult. Existing literature is vicious in terms of evaluating the role of an inflation targeting regime such features. We evaluate the role of an inflation targeting regime by dividing for all samples into groups of upper-middle income and high-income countries, emerging and developed economies, OECD members, Europe and Central Asia economies. Using a more comprehensive dataset enhances the credibility of the results. Table 2.1-2.5 indicate the sample group chosen for the study and the adoption dates for countries. Inflation targeters are drawn from IMF Annual Report on Exchange Rate Arrangements and Exchange Rate Restrictions (2017) and central bank web sites. Country classification is obtained from World Economic Outlook in April 2020. While upper-middle-income economies indicate \$3.996 to \$12.375, high-income-economies refer to \$12.376 or more. Dates show an explicit inflation target date for each of the countries, which indicates the entire transition periods and the absence of other nominal anchors.

Table 2.1 *Developed Economies*

Inflation Targeting: Australia (1994), Canada (1992), Czech (1998), Iceland (2001), Israel(1997), Japan (1998), Korea (1998), New Zealand (1990), Sweden (1995), Switzerland(2000), United Kingdom(1992), United States(2012)
Non-Inflation Targeting: Austria, Belgium, Cyprus, Denmark, France, Finland, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Norway, Portugal, Singapore, Spain, Slovak, Slovenia.

Table 2.2 *Emerging and Developing Economies*

Inflation Targeting: Albania (2009), Armenia(2006), Brazil (1999), Chile(1999), Colombia (1999), Dominican Republic (2012), Ghana(2007), Georgia(2012), Guatemala (2005), Hungary (2001), Indonesia (2015), Mexico (2001), Moldova (2010), Paraguay (2011), Peru (2002), Philippines(2002), Poland(1999), Romania(2005), Russia (2015), South Africa(2000), Thailand(2000), Turkey (2006), Ukraine(2005), Uruguay(2007)
Non- Inflation Targeting: Algeria, Barbados, Bahamas, Bangladesh, Belarus, Bhutan, Bolivia, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Cambodia, China, Congo Republic, Cote d'Ivoire, Croatia, Dominica, Ecuador, Egypt Arap Rep, El Salvador, Eswatini, Equatorial Guinea, Fiji, Gabon, Gambia, Grenada, Haiti, Honduras, Iran, Jamaica, Jordan, Kenya, Kuwait, Lesotho, Malawi, Malaysia, Mali, Mauritius, Myanmar, Morocco, North Macedonia, Nigeria, Pakistan, Panama, Papua New Guinea, Saudi Arabia, Senegal, Seychelles, Sri Lanka, St. Kitts and Nevis, St.Lucia, St. Vincent and the Grenadines, Sudan, Tanzania, Togo, Trinidad and Tobago, Tunisia, Vanuatu, Vietnam, Zambia.

Table 2.3 *OECD Economies*

Inflation Targeting: Australia (1994), Canada (1992), Chile (1999), Colombia (1999), Czech Republic (1998), Iceland (2001), Israel (1997), Japan (1998), Georgia (2012), Hungary (2001), Korea (1998), Mexico (2001), New Zealand (1990), Poland (1999), Sweden (1995), Switzerland (2000), Turkey (2006), United Kingdom (1992), United States (2012)
Non-Inflation Targeting: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Slovak, Slovenia, Spain

Table 2.4 *Upper-Middle Income Economies*

Inflation Targeting: Armenia (2006), Brazil (1999), Colombia (1999), Dominican Republic (2012), Georgia (2012), Peru(2002), Romania(2005), Russia(2015), Mexico (2001), South Africa (2000), Thailand (2000), Turkey (2006)
Non-Inflation Targeting: Algeria, Belize, China, Equatorial Guinea, Fiji, Gabon, Grenada, Guatemala, Iran, North Macedonia, Paraguay, Malaysia, St.Lucia, St.Vincent

Table 2.5 *High Income Economies*

Inflation Targeting: Australia (1994), Canada (1992), Chile(1999), Czech Republic (1998), Iceland (2001), Israel (1997), Japan (1998), Korea (1998) , New Zealand(1990), Poland (1999), Sweden (1995), Switzerland(2000), United States (2012), Uruguay (2007)
Non-Inflation Targeting: Austria, Antigua and Barbados, Bahamas, Barbados, Belgium, Croatia, Cyprus, Denmark, Estonia, Finland, Germany, Greece, Ireland, Kuwait, Latvia, Luxembourg, St.Kitts and Nevis, Malta, Netherlands, Norway, Oman, Panama, Portugal, Saudi Arabia, Seychelles, Singapore, Slovak, Slovenia, Spain, Trinidad and Tobago

CHAPTER 3

3. ANALYZING THE EFFECTS OF INFLATION TARGETING ON INFLATION RATE AND INFLATION VOLATILITY

Results of unsuccessful monetary policy show that an effective monetary policy is closely related to the ability of economic agents to follow the decisions of the central banks (de Mendonça and Filho, 2008). Therefore, central banks have given great importance to the principle of providing reliability and transparency while conducting their monetary policy under the inflation regime. The most crucial reason the central banks emphasize transparency is to reduce uncertainties regarding monetary policy decisions on the private sector and economic agents (Dincer and Eichengreen, 2014). Facilitating the traceability of the central bank's decisions ensures the effective functioning of monetary policy and leads to keep inflation stabilization (Geraats, 2002). Besides, countries applying the inflation targeting regime determine their inflation rates with a forward-looking approach. This increases the signaling power of the central bank and causes monetary transmission mechanisms to function well. Inflation targeting is expected to positively affect reducing general price level and inflation volatility due to the advantages that the inflation target provides for the effective monetary policy.

3.2. Variables for Inflation Rate and Inflation Volatility

We first estimate the propensity score using a probit model to decide which variables should be included in this model.

$$Pr(iters = 1) = f(exgs, imgs, cab, rim, loggdpc, gdp gv, bnks, totv) \quad (3.2)$$

In equation 4.11, “iters” refers to a binary treatment indicator. If the country adopts inflation targeting, the regression value takes “1” and “0” otherwise. The right side of the function in the above equation refers to control variables that increase the likelihood of transition to the inflation targeting regime and determines the dynamics of the inflation rate and its volatility. The employed control variables are: The real GDP per capita (loggdpc), domestic credit to the private sector by banks as a share of GDP (bnks), exports of goods and services are share of GDP (exgs), imports of goods and services as a share of GDP (imgs), volatility on economic growth rate (gdp gv), current account balance as a share of GDP (cab), reserves in the month of imports (rim), and terms of trade volatility

(totv). The matching strategy requires to select a set of variables that satisfy the conditional independence assumption. According to the probit estimation results, the relationship between the variables and their expectations are as follows.

- Targeting countries should be adopted only after some preconditions are met.
- It provides an arbitrary process regarding the choice of switching inflation targeting.
- They are related statistically to the consequences of inflation and inflation volatility

Real GDP per capita: This variable is the level of economic development. Lucotte (2012) and Samarina et al. (2013) assert that countries with lower economic performance are a higher probability of the inflation targeting framework. Therefore, we expect inversely correlated with choosing an inflation targeting regime.

Domestic credit to the private sector of banks as a share of GDP (bnks) indicates a country's financial depth. Financial depth is related to financial resources, such as loans and non-equity securities, available to the private sector. According to the discussed literature, high credit rates to the private sector indicate a higher financial level. The sound banking system is necessary for implementing an inflation targeting regime to be successful. With higher financial development level represents an effective monetary policy transmission mechanism through well-functioning capital markets.

Reserves in months of imports show the international reserves in the country. This ratio is related to precautionary savings. While economies face any external shock or crisis environment, higher reserves help to manage crises and mitigate inflationary pressure and its volatility. Therefore, a higher reserve ratio causes more likelihood of adoption inflation targeting framework.

The current account balance is the exportation minus importation of goods and services as a share of GDP, which shows the external position of the county. The current account balance influences the general price level in two corners: Decreasing or increasing inflationary pressure. The overall effect is ambiguous. On one aspect, there is a surplus of domestic demand when a country has a deficit position. This shows a higher ratio of imports demand for goods and services. It may create reducing pressure on inflation, or rising imports may cause a higher price level. However, on the other hand, a

lower ratio of the current account is related to reduce aggregate demand and stabilization in the general price level.

Volatility in GDP growth rates is considered as one of the primary sources of inflation and inflation volatility. Recently policy experiences indicate that high inflation rate and inflation variability have detrimental effects on economic performance. Higher GDP growth rate variability (gdpgv) causes macroeconomic policy decisions that become ineffective.

Terms of trade volatility imply fluctuations in the price of exports relative to the price of imports. Fluctuations in a country's terms of trade, such as a drastic fall in the price of a primary product, can cause serious balance-of-payments problems. High variability can also adversely influence the economy's growth through the reallocation of both inputs. A higher ratio creates an uncertain situation with high relative price volatility of both inputs and outputs.

Following, we control the overlap between inflation targeters and comparison groups. The common support graph offers a visual analysis of the density distribution through the estimated propensity score in both groups. This is a crucial step to decide about the overlapping area between inflation targeters and non-inflation targeters. Applying the common support condition confirms that any grouping of characteristics observed in inflation targeting countries can also be observed in the non-inflation targeting countries.

After the empirical two steps are accomplished, the third step is to estimate the average treatment effect. Consequently, all samples are ranked according to estimated propensity scores. Then, units that predict the lowest scores from the inflation targeters points are dropped out. For analyzing the average treatment effect on the adoption of inflation targeting are estimated on the inflation rate and its variability as outcome variables. The data on the inflation rate refers to CPI annual change. Inflation rate volatility is measured by using a three-year moving average standard deviations. After all this process, we utilize three propensity score matching method: Nearest-neighbor matching, propensity score matching, and Kernel matching to examine the average treatment effect of adopting inflation targeting

3.3. Results for All Sample Economies Inflation Rate and Inflation Volatility

Table 3.1 shows propensity score ratios according to the result of the probit regression analysis. Countries with higher export growth rates are more likely to adopt inflation targeting in all samples and subsample, which are excluded from all samples to G7 countries and the Euro area. The import ratio creates a negative influence to decrease the inflation rate and its variability. The level of financial development is the positively correlated implementation of an inflation targeting monetary framework. However, the coefficient of financial development leads to a smaller increased effect on monetary policy preference. Countries with current account deficit are negatively correlated likelihood adoption of inflation targeting regimes. Higher international reserves have inflationary pressure. In countries that have poor economic development can lead to higher likelihood adoption of inflation targeting framework. When the probit regression results are examined, countries' position about the current account and economic growth volatility is not relevant to choose an inflation targeting regime and affects outcome variables in all groups. However, the inclusion of insignificant explanatory variables in the regression does not prevent the balancing hypothesis. There is no obstacle in matching countries that are similar in terms of the variables defined.

Table 3.1 *Probit Estimation Result for All Sample for Inflation Rate and Its Volatility*

	All Sample		All Sample- Exclude G7		All Sample -Exclude G7 and Euro Area	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
exgs	0.011 (0.004)	0.017**	0.009 (0.006)	0.051*	-0.012 (0.005)	0.012**
imgs	- 0.260 (0.005)	0.000***	-0.024 (0.038)	0.000***	-0.028 (0.005)	0.000***
cab	- 0.009 (0.006)	0.165	-0.005 (0.001)	0.385	-0.009 (0.006)	0.167
rim	0.032 (0.006)	0.000***	0.037 (0.037)	0.026**	0.020 (0.007)	0.007***
loggdpc	- 0.2123 (0.006)	0.023**	-0.122 (0.550)	0.026**	-0.144 (0.055)	0.010**
gdpgv	- 0.021 (0.163)	0.183	-0.014 (0.162)	0.386	-0.008 (0.016)	0.616
bnks	0.007 (0.000)	0.000***	0.007 (0.008)	0.000***	0.011 (0.001)	0.000***
totv	-0.159 (0.304)	0.000***	-0.158 (0.303)	0.000***	-0.160 (0.031)	0.000***
cons	-0.164 (0.235)	0.000***	0.175 (0.236)	0.457	-1.116 (0.175)	0.650
Number of obs.	2.457		2.305		2.110	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.						

Figure 3.1, 3,2 and 3,3 shows the numerical densities of countries adopted and not adopted inflation, according to their propensity score ranges. The horizontal section in the chart indicates the propensity score range, while the vertical section indicates the number of countries. The blue blocks below the horizontal line show countries that do not adopt the inflation targeting regime. The red blocks above the horizontal line indicate the country group that has adopted the inflation targeting regime. When the balancing hypothesis occurs, countries with similar propensity scores have a similar distribution of observable and unobservable features, regardless of their monetary policy preference. From the Figure in 3.1,3.2 and 3.3, it is observed that the propensity scores of targeting and non-targeting countries converge and common support is provided.

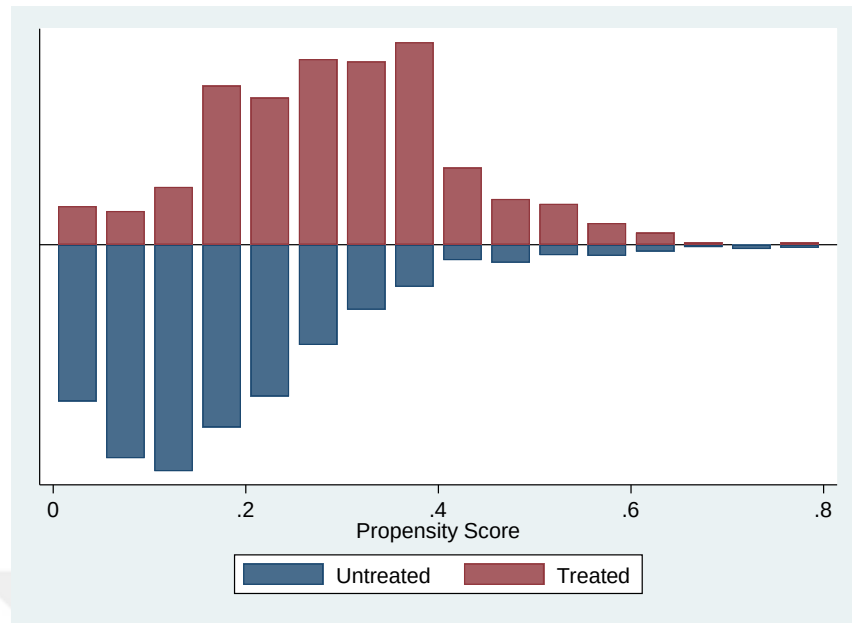


Figure 3.1. *Common Support Graph for All Sample for Inflation Rate and Its Volatility*

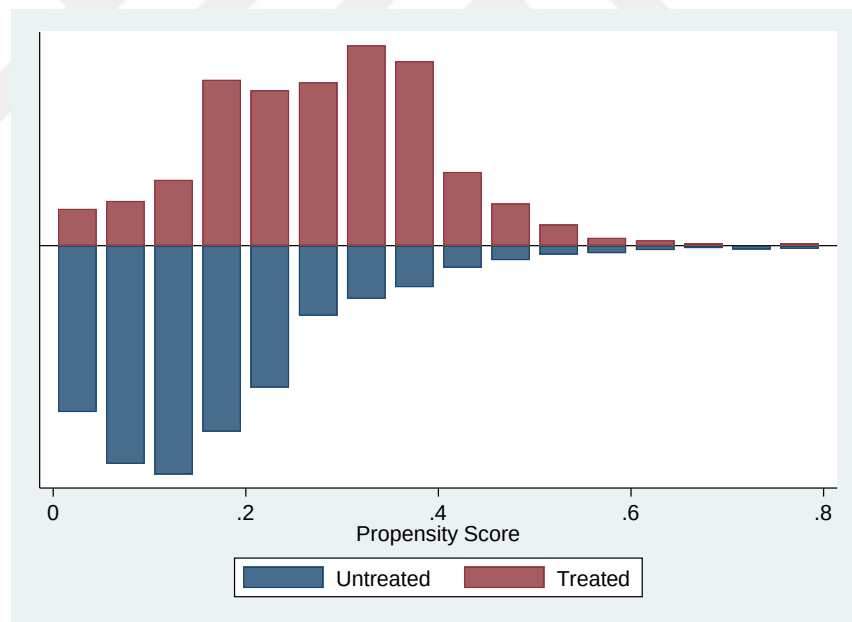


Figure 3.2. *Common Support Graph for Exclude G7 for Inflation Rate and Its Volatility*

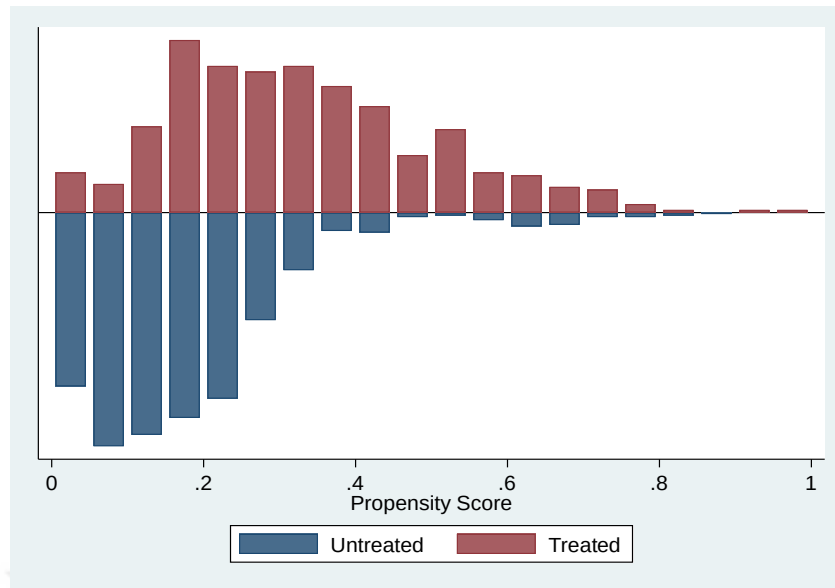


Figure 3.3. *Common Support Graph for exclude G7 and Euro Area Inflation Rate and Its Volatility*

Table 3.2, 3.3, 3.4, and 3.5 present matching results with different matching estimator techniques. After considering different matching estimators, the impact of the treatment effect on the inflation rate and its variability have negative coefficients. They are statistically significant irrespective of the utilized matching technique. Table 3.2 reports treatment effect with $n=1$, $n=3$, and $n=5$. The applied matching analysis suggests strong treatment effects of adopting inflation targeting, reducing the inflation rate for all samples. While the result of the one-to-one nearest neighbor matching technique provides a decrease in 9.293 percentage points, three-nearest neighbor matching provides 9.868 on the inflation rate. Propensity score matching results offer highest magnitude on reducing the inflation volatility by 25.919. Table 3.3 reveals a similar result regarding the impact of the treatment on the inflation volatility. Put simply, after considering different matching techniques, and the results provide strong evidence of estimated ATT on the inflation rate and inflation volatility decreasing and statistically significant interpretation for inflation targeting countries. On the other hand, if non-inflation targeting countries had adopted inflation targeting, their inflation rate would have decreased between 9.293 and 12.417.

The impact of inflation targeting on decreasing inflation rates can change depending on the institutional characteristics of the economies. Therefore, the effect of the inflation

rate is also analyze excluded G7. They have not very high inflation rates before the transition regime and also central bank independence. Matched results with excluding G7 suggest a reduction magnitude of inflation rate raises. To deeper analysis, we remove Euro areas. Euro area comprises that do not implement inflation targeting. They apply a particular monetary policy that they implement within. Removed the countries, we document inflation targeting treatment effect has an increased 1 percent value.

These results support inflation targeting proponents, who claim that transparency and reliability are among the advantages of inflation targeting. Enhancement transparency leads to price level and uncertainty reduction. When compared to the other non-inflation targeting results show that the inflation targeting regime contributes to creating reliance macroeconomic environment in monetary policy.

Table 3.2. Nearest Neighbor Matching Result for All Sample-Inflation Rate

Distance Metric: Mahalanobis						
ITers (inflation targeters vs non-inflation targeters)						
ATE on inflation rate	n=1		n=3		n=5	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
All Sample	-9.293 (2.460)	0.000***	-9.868 (2.292)	0.000***	-9.972 (2.297)	0.000***
All Sample excluded G7	-9.873 (2.622)	0.000***	-10.732 (2.545)	0.000***	-10.670 (2.481)	0.000***
All Sample Excluded G7 and Euro Area	-10.962 (2.751)	0.000***	-11.663 (2.640)	0.000***	-12.147 (2.685)	0.000***
Number of obs.	2.457		2.305		2.110	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.						

Table 3.3 *Nearest Neighbor Matching Result for All Sample-Inflation Rate Volatility*

Distance Metric: Mahalanobis						
ITers						
(inflation targeters vs non-inflation targeters)						
ATE on inflation volatility	n=1		n=3		n=5	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
All Sample	-13.540 (3.889)	0.000***	-14.478 (0.006)	0.000***	-15.410 (0.005)	0.000***
All Sample excluded G7	- 16.083 (7.834)	0.040***	-15.618 (4.089)	0.000***	-16.226 (4.252)	0.000***
All Sample Excluded G7 and Euro Area	-15.890 (4.717)	0.001***	-16.775 (4.720)	0.000***	-17.867 (4.814)	0.000***
Number of obs.	2.457		2.305		2.110	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.						

Table 3.4 *Propensity Score Matching for All Sample-Inflation Rate and Its Volatility*

Number of observations:1.796 Treatment Model: Logit						
	All Sample		All Sample Exclude G7		All Sample Exclude G7 and Euro Area	
ITers (inflation targeters vs non inflation targeters)	Coef	Prob	Coef	Prob	Coef	Prob
ATE on inflation rate	-9.979 (4.252)	0.019**	-23.792 (8.763)	0.007*	-23.792 (8.763)	0.007*
ATE on inflation volatility	-25.919 (11.053)	0.019**	-28.296 (10.744)	0.008*	-28.296 (10.744)	0.008*
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.						

Table 3.5 Kernel Matching Result for All Sample-Inflation Rate and Its Volatility

Number of observations:1.796						
Treatment Model: Logit						
	All Sample		All Sample Exclude G7		All Sample Exclude G7 and Euro Area	
ITers (inflation targeters vs non inflation targeters)	Coef	Prob	Coef	Prob	Coef	Prob
ATE on inflation rate	-9.650 (2.128)	0.000***	-10.261 (2.281)	0.000***	--23.792 (8.763)	0.007***
ATE on inflation volatility	-17.091 (4.248)	0.000***	-18.152 (4.515)	0.000***	-28.296 (10.744)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.						

3.4. Results for Developing and Emerging Economies Inflation Rate and Inflation Volatility

Compared to developed economies, developing and emerging economies suffer more inflation phenomena before adopting the inflation targeting framework. Indeed, with the implementation of inflation targeting countries reduces inflation and keep it under control. To support that the regime has a positive significance on inflation rates and successful in reducing inflation volatility, it is expected that the matching results of countries that inflation targeting countries will show a statistical difference compared to countries that non-inflation targeting.

The result of probit regression analysis shows that higher import ratio, terms of trade shock impact negative, and significant probability of inflation targeting adoption and inflation stabilization. More international reserves, more financial development, sound fiscal position have a positive sign to choose the inflation targeting regime. Current account, export goods, and services, GDP growth variability is not relevant to adopt an inflation targeting regime. However, since we would like countries targeting inflation to have similar characteristics with non-inflation targeters, this variable does not obtain the balancing hypothesis.

Table 3.6. *Probit Estimation for Emerging and Developing Economies-Inflation Rate and Its Volatility*

Emerging and Developing Economies		
	Coefficient	Prob
exgs	-0.004 (0.005)	0.434
imgs	-0.019 (0.005)	0.000***
loggdpc	-0.186 (0.066)	0.005***
gdpgv	0.008 (0.017)	0.631
rim	0.034 (0.008)	0.000***
cab	0.004 (0.007)	0.550
bnks	0.007 (0.001)	0.000***
totv	-0.150 (0.034)	0.000***
Number of observations	1.802	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Figure 3.4 illustrates that the propensity score ranges through the numerical densities of inflation targeting countries or not inflation targeters. The red bar chart indicates inflation targeting countries, and the blue bar chart indicates non-inflation targeting countries. If the blue and red blocks show a balanced distribution, common support between treated and untreated units is provided. Thus, after obtaining overlapping condition, control, and treatment individuals give unbiased results.

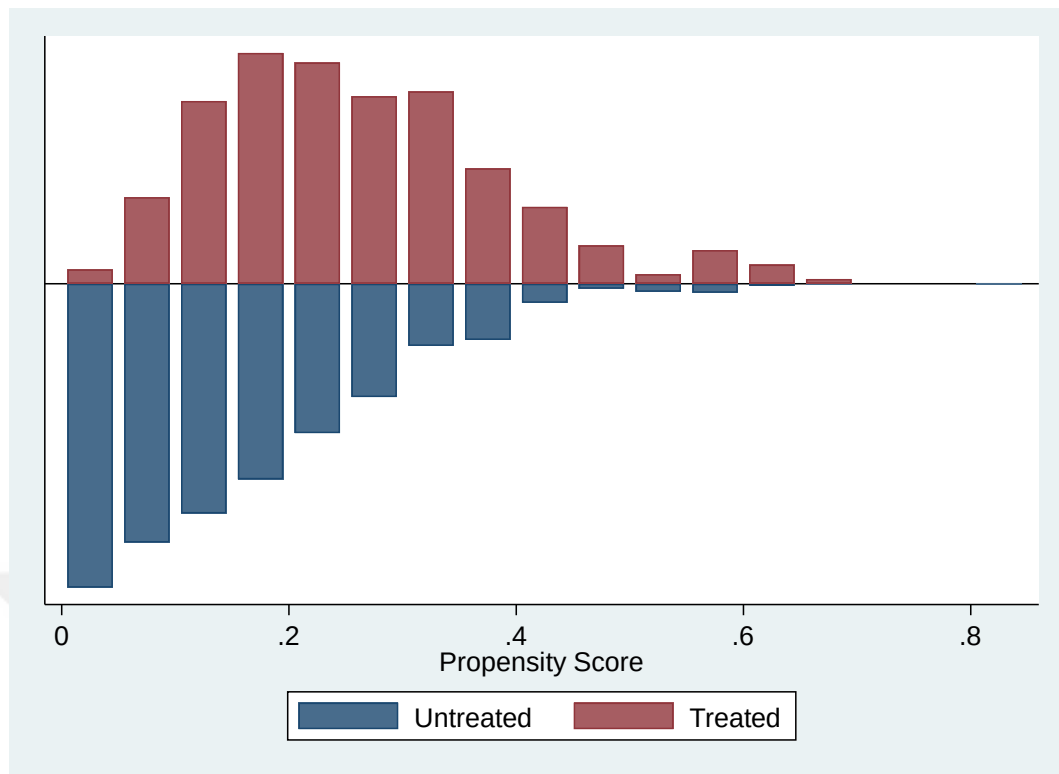


Figure 3.4. *Common Support for Emerging Economies-Inflation Rate and Its Volatility*

Table 3.7, 3.8, and 3.9 presents the matching results of the inflation rate and its variability based on the emerging and developing sample. Matching results are strong and robust. The estimated average treatment effect on a sample from one-to-one, three-nearest-neighbor, and five-nearest neighbor matching find negative and statistically significant regarding the inflation rate. Focussing on inflation volatility, inflation targeting regime helps the lower rate of inflation and its variability. Evaluation average treatment effect on inflation targeting by Propensity Score and Kernel matching offers similar results with nearest-neighbor matching. As a result, on average, the adoption of inflation targeting affects a fall in the rate of inflation by nearly 13 percentage points and variability by nearly 16 percentage.

Table 3.7. Nearest Neighbor Matching Result for Developing and Emerging Economies-Inflation Rate and Its Volatility

Distance Metric: Mahalanobis				
ITers (inflation targeters vs non-inflation targeters)				
	ATE on inflation rate		ATE on inflation volatility	
	Coefficient	Probability	Coefficient	Probability
n=1	-11.21 (2.909)	0.000***	-14.508 (4.347)	0.001***
n=2	-12.051 (2.960)	0.000***	-14.744 (4.178)	0.000***
n=3	-12.905 (3.078)	0.000***	-16.284 (4.346)	0.000***
Number of observations	1.799		1.796	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.				

Table 3.8. Propensity Score Matching Result for Developing and Emerging Economies-Inflation Rate and Its Volatility

Number of observations:1.796 Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on inflation rate	-10.446 (3.334)	0.002***
ATE on inflation volatility	-13.918 (3.875)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 3.9. Kernel Matching Result for Developing and Emerging Economies- Inflation Targeting and Its Volatility

Number of observations:1.799		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
Kernel: epan	Coefficient	Probability
ATE on inflation rate	-21.339 (6.056)	0.000***
ATE on inflation volatility	-22.672 (5.448)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Regardless of the specific indicator of matching technique, inflation targeters access have a negative and significant impact under the inflation targeting regime. The inflation targeting regime helps reduce uncertainty. We find that the adoption of inflation targeting regime reveals lowers inflation rates, and stable inflation variability in developing economies is consistent with de Mendonça de and Guimeraes e Souza (2010), Lin and Ye (2007), Lin (2010). In the case of the inflation rate, inflation targeting helps to obtain lower inflation rates, and these results are statistically and economically significant for the developing and emerging economies. Concerning inflation variability, the conclusion is suggestive of the likelihood that inflation targeting regime plays more as a credible and robust nominal anchor for inflationary expectations in developing and emerging economies and helps stabilize monetary policies.

3.5. Results for Developed Economies Inflation Rate and Inflation Volatility

Table 3.10 suggests that all coefficients are relevant to adopt an inflation targeting regime. Countries with higher export ratio, financial development, foreign reserves are more likely to choose an inflation targeting in the emerging sample. The strong current account position creates a negative influence regarding on inflation rate and its volatility. Fluctuations in economic growth rate, terms of trade volatility is inversely correlated on reducing inflation rate and its volatility.

Table 3.10. *Probit Estimation for Developed Economies- Inflation Rate and Its Volatility*

Developed Economies		
	Coefficient	Prob
Exgs	0.104 (0.021)	0.000***
Imgs	-0.126 (0.023)	0.000***
Loggdpc	-0.960 (0.221)	0.000***
Gdp _{gv}	-0.095 (0.041)	0.022***
Rim	0.097 (0.182)	0.000***
Cab	-0.004 (0.019)	0.000***
Bnks	0.007 (0.001)	0.001***
Totv	-0.103 (0.093)	0.270
Number of observations	627	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

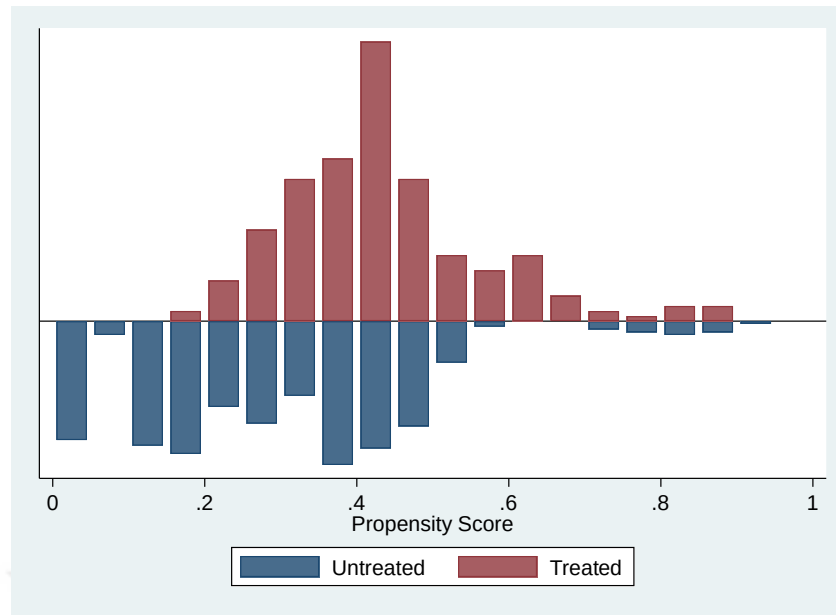


Figure 3.5. *Common Support for Developed Economies-Inflation Rate and Its Volatility*

Table 3.11, 3.12, and 3.13 summarize the average treatment effect on the inflation rate and its volatility in developed economies. In the inflation targeting countries, inflation rates have a positive effect but insignificantly after adopting the regime. Whatever using matching technique gives a similar result, the average inflation rate and its variability has not led to any significant effect than the non-inflation targeting countries. In developed economies, the inflation targeting regime seems to decrease the inflation rate and its variability, no matter which estimation technique is used. Since developed inflation targeters already have robust macroeconomic foundations, there is no institutional change in developed economies after the regime.

Table 3.11. Nearest-Neighbor Matching Results for Developed Economies- Inflation Rate and Its Volatility

Distance Metric: Mahalanobis				
ITers (inflation targeters vs non-inflation targeters)				
	ATE on inflation rate		ATE on inflation volatility	
	Coefficient	Probability	Coefficient	Probability
n=1	0.016 (0.172)	0.926	0.053 (0.078)	0.498
n=3	0.016 (0.140)	0.909	0.041 (0.063)	0.507
n=5	0.010 (0.132)	0.936	0.058 (0.059)	0.329
Number of observations	627		627	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.				

Table 3.12. Propensity Score Matching Result for Developed Economies- Inflation Rate and Its Volatility

Number of observations:627		
Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on inflation rate	0.048 (3.334)	0.887
ATE on inflation volatility	-0.050 (0.120)	0.677
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 3.13. Kernel Matching Result for Developed Economies- Inflation Rate and Its Volatility

Number of observations:627		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
Kernel: epan	Coefficient	Probability
ATE on inflation rate	0.057 (0.142)	0.685
ATE on inflation volatility	0.033 (0.070)	0.637
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

These results confirm that Lin and Ye (2007) the inflation targeting framework are not more successful than the non-inflation targeting countries for developed economies in terms of lowering and stabilizing their inflation rates. Unlike claims of Ball and Sheridan (2005) is that developed non-inflation targeting countries decline substantially. Therefore, we conclude that inflation targeters do not differ in terms of the inflation rate.

3.6. Results for OECD Member Inflation Rate and Inflation Volatility

According to Table 3.14, in comparison, the higher export ratio increases the likelihood of adoption, and the import ratio decreases. The impact of real GDP per capita is negative: the lower economic development, the higher the chances a country will become an inflation targeter. Higher GDP growth fluctuations in the economy are inversely related adoption of inflation targeting and inflation stabilization. If countries have a higher level of financial development, adopted inflation targeting regime is positively affected. Regarding terms of trade volatility, when this ratio is higher, the country becomes vulnerable to external shocks. Probit regression results present only except terms of trade volatility is insignificant, other covariates significant, and the coefficient sign in regression is as expected.

Table 3.14. *Probit Estimation for OECD Member Economies- Inflation Rate and Its Volatility*

OECD MEMBER		
	Coefficient	Prob
Exgs	0.057 (0.018)	0.001***
Imgs	-0.061 (0.019)	0.002***
Loggdpc	-0.798 (0.163)	0.000***
Gdpgv	-0.108 (0.033)	0.001***
Rim	0.101 (0.015)	0.000***
Cab	-0.006 (0.017)	0.000***
Bnks	0.007 (0.001)	0.001***
Totv	-0.024 (0.615)	0.687
Number of observation	790	
Prob > Chi^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

After estimating propensity scores, we analyze the distributions in Figure 3.4 that refer to a common support feature. Common support eliminates noncomparability bias. If countries belong to the control groups, a bar chart is shown with the blue blocks. If countries belong to the treatment groups, a bar chart is shown with the red blocks. Multiple different block groups are representing the matching technique that provides a balancing feature. The balancing hypothesis means a similar propensity score through similar distribution between observable and unobservable features, irrespective of monetary policy preference. Figure 3.7 verifies that the common support assumptions of propensity score matching is met.

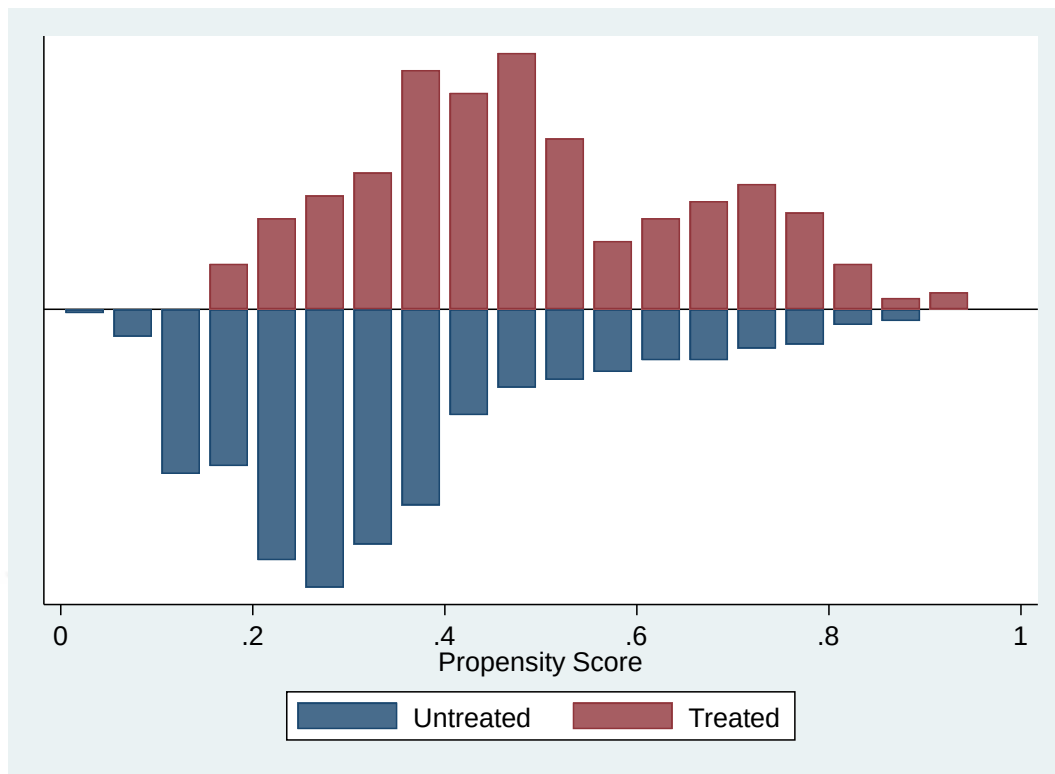


Figure 3.6. *Common Support for OECD Member- Inflation Rate and Its Volatility*

Table 3.14, 3.15, and 3.16 provide the treatment impact of inflation targeting the inflation rate and its volatility with $n=1$, $n=3$, $n=5$, propensity score, and Kernel matching. Matching results reveal, on average 4.50 percentage on inflation rate and 1 percentage inflation volatility. The result of the propensity score matching estimation concludes that inflation targeting regime is successfully controlling inflation expectations.

Table 3.15. *Nearest Neighbor Matching Result for OECD Member- Inflation Rate and Its Volatility*

Distance Metric: Mahalanobis				
ITers (inflation targeters vs non-inflation targeters)				
	ATE on inflation rate		ATE on inflation volatility	
	Coefficient	Probability	Coefficient	Probability
n=1	-4.550 (0.555)	0.000***	-1.089 (0.276)	0.000***
n=3	-4.519 (0.518)	0.000***	-1.091 (0.268)	0.000***
n=5	-4.496 (0.510)	0.000***	-1.122 (0.269)	0.000***
Number of observations	790		786	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.				

Table 3.16. *Propensity Score Matching Result for OECD Member-Inflation Rate and Its Volatility*

Number of observations:790 Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on inflation rate	-4.550 (0.555)	0.000***
ATE on inflation volatility	-1.089 (0.276)	0.000***

Table 3.17. Kernel Matching Result for OECD Member- Inflation Rate and Its Volatility

Number of observations:790 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
Kernel: epan	Coefficient	Probability
ATE on inflation rate	-4.037 (0.682)	0.000***
ATE on inflation volatility	-1.123 (0.325)	0.001***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Matched estimation groups OECD member economies provides a more robust and strong result for reducing inflation rate and its volatility. On the other hand, if non inflation targeters OECD members had adopted inflation targeting, their reducing inflation rate and its volatility would have been on average 4 percent.

OECD members have similar socio-economic characteristics. Compared to the reduction of the inflation rate and its volatility in developing and emerging economies, the OECD inflation targeters have a smaller effect among non-inflation targeters. Since developing and emerging economies include much heterogeneity, the magnitude of the result is not surprising. However, lower inflation rate and its volatility in OECD inflation targeters suggest that inflation targeting regime indicate a successful nominal anchor in an economy.

CHAPTER 4

4. ANALYZING THE EFFECTS OF INFLATION TARGETING ON REAL EXCHANGE RATE VOLATILITY

In characteristic, the implementation of an inflation targeting regime has to the absence of any commitment to a specific level of the exchange rate. The common wisdom is that limiting exchange rate fluctuations in an implicit or explicit policy target, the central bank's policy intention, and decisions send a signal about to give the privilege to price stability not over other objectives of monetary policy. The lack of credibility of the central bank in terms of the expectation of public and private agents causes higher and more persistent inflation expectations. Therefore, for the functioning of an inflation targeting regime is the matter with the adoption inflation target in a country that has greater exchange rate flexibility. Therefore, after the inflation targeting adoption is not surprising, the increased variability of the exchange rate because of these requirements.

The exchange rate is essential under inflation targeting in transmitting the effects of both changes in policy interest rates and domestic disturbances. A high degree of volatility in exchange rate damages relative price signals to domestic producers and affect the distribution of resources negatively. Large volatilities in exchange rates can lead to deterioration balance sheets and massive portfolio shifts between domestic and foreign currency-denominated assets.

4.1. Variables for Real Effective Exchange Rate Volatility

Data is obtained from the International Monetary Fund's International Financial Statistics to evaluate the effect of the inflation targeting regime on the real effective exchange rate (REER). REER variable refers to the multilateral (effective) exchange rate employs that defined as the consumer price index (2010=100). We follow Lin (2010) and Rose (2007) measurement to calculate real effective exchange rate volatility. First, we collect monthly observations of real effective exchange rate and after takes the natural logarithms of the monthly observations for each year. Then, the standard deviation of a country's log effective exchange rates are estimated.

First, estimation propensity scores evaluate to determine the probability of treatment on observable characteristics. The propensity score is used by probit regression.

$$Pr(iters = 1) = f(cab, gdpcg, bnks, rim, gdpg, topn) \quad (4.1)$$

Equation 4.1 shows that countries that adopted inflation target are indicated with a dummy variable that takes the value “1”, and not adopted countries take the value “0”. Covariates are considered to increase the likelihood of adoption inflation targeting regime are settled up on the right side of the function. Current account balance as a share of GDP (*cab*), the ratio of domestic credit to the private sector by banks(*bnks*), real GDP per capita growth rate (*gdpcg*), trade openness(*topn*), reserves in months of imports(*rim*) and economic growth rate(*gdpg*) are control variables for estimating the propensity scores. All the control variables are obtained from the World Bank’s World Development Indicators. Selected variables reflect that:

- (i) They are adopted only after institutional and economic preconditions are met,
- (ii) They affect the outcome indicator.

Current Account Balance: Variable refers to the ratio of the current account to GDP, which depicts external sustainability.

GDP per capita Growth Rate: de Mendonça (2012) highlights that the growth rate of real gross domestic product per capita (2010\$) is a good indicator for the development size of nations. Also, Leyva (2008) suggests that this is also a proxy for central bank credibility. We anticipate that higher economic development has a beneficial effect on the transition to this monetary policy framework.

Reserves in months of imports: This is a measure of international exchange reserves coverage and is expected to be negatively correlated with the probability of adopting an inflation targeting regime. The availability of FX reserves is particularly crucial for the viability and the credibility of pegged exchange rate regimes, as it provides the monetary authorities with some room to maintain the parity in case of shocks.

Trade openness: The degree of economic openness causes a restrictive effect on exchange rate stability than non-inflation targeting countries. According to the theory of optimum currency areas (Mundell, 1961) offer low trade openness is more suitable.

Domestic credit to the private sector by banks of GDP: Private credit to GDP ratio shows financial resources provided to the private sector by financial intermediaries. In the literature, this ratio indicates one of the financial development indicators that a rising ratio is associated with a good level of financial development. Improving the financial

sector causes well-functioning the transmission mechanisms of monetary policy. Inflation targeting countries with greater financial development exhibit tend to have independent monetary authority.

Real GDP Growth: Economic growth demonstrates the business cycle condition for countries. Since a faster economic growth rate creates a lack of credibility environment, we expect this variable is negatively correlated with a stable exchange rate.

4.2. Results for All Sample- Real Exchange Rate Volatility

Table 4.1 demonstrates the probable outcomes of being an inflation targeter. All covariates are statistically substantial at conventional levels. The current account surplus displays a higher level of exchange rate volatility. Higher economic growth, more trade openness show increasing exchange rate volatility. The likelihood of adoption inflation

Table 4.1. *Propensity Score Result for All Sample-REERV*

All Sample		
	Coef.	Prob
Cab	0.013 (0.004)	0.004***
Gdpcg	0.266 (0.031)	0.000***
Bnks	0.006 (0.000)	0.000***
Rim	0.025 (0.006)	0.000***
Gdpg	- 0.242 (0.00	0.000***
Topn	- 0.007 (0.000)	0.000***
Cons	-0.495 (0.112)	0.000***
Number of observations	1.802	
Prob > Chi^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

targeting is much more in financially developed and strong economic development rate countries. The volatility of the exchange rate pertains if countries have a more international reserve ratio.

Figure 4.1 illustrates the densities of countries adopted and not adopted inflation, according to their propensity score ranges. The blue blocks below the horizontal line indicate countries that do not implement the inflation targeting regime. The red blocks above the horizontal line reveal the country group that has adopted the inflation targeting regime. From the figure in 4.1, we obtain a result that the propensity scores of targeting and non-targeting countries converge; thereby, common support is provided.

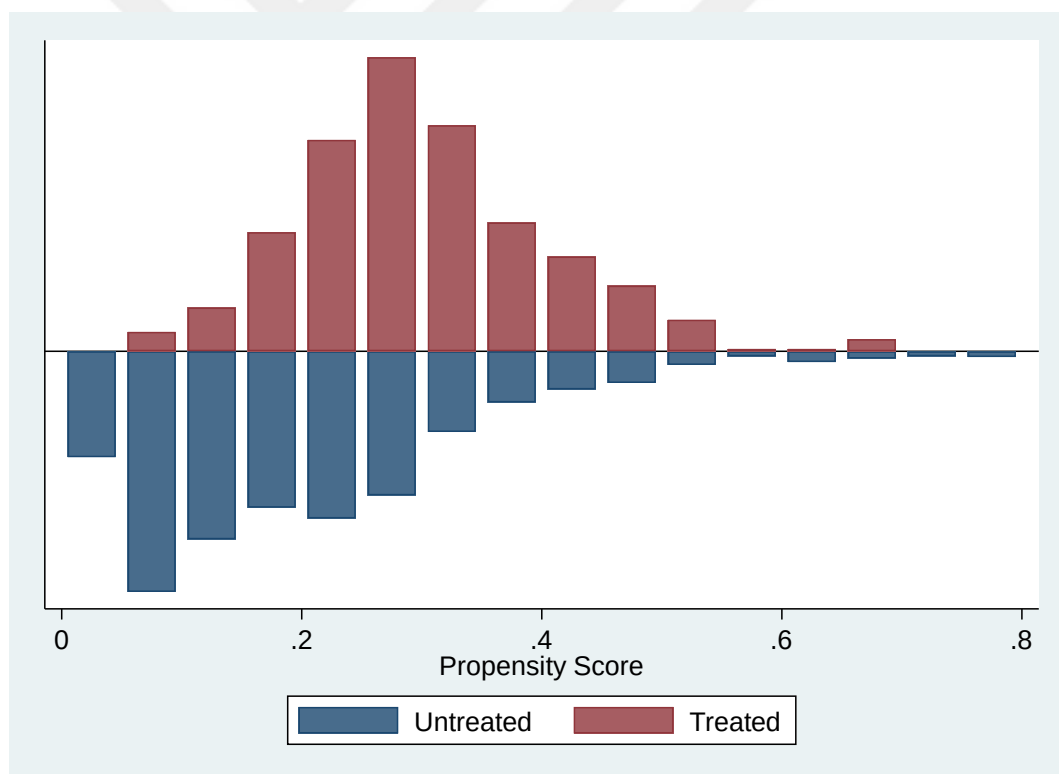


Figure 4.1. *Common Support for All Sample- Real Exchange Rate Volatility*

Table 4.2, 4.3, and 4.4 summarize matching results for treatment effect on real exchange rate volatility. While the nearest-neighbor and propensity score matching results are statistically significant, kernel matching does not find significant. The impact

on stable exchange rate volatility of implementing inflation targeting framework is smaller. The average exchange rate volatility reduction is between 0.002 and 0.003 percent. To be more precise, if non-inflation targeting countries had adopted inflation targeting, their inflation rate would have been 0.003 percent lower. If we use the nearest neighbor matching with $n=3$ and $n=5$, there is a significant difference in the stable exchange rate at a level of 10 percent. Inflation targeting countries with selected no intermediate regime to obtain more stable exchange rate volatility. Our results, as consistent with the transition of an inflation targeting regime, allow us to use internal dynamics and thereby reducing exchange rate volatility any facing shock.

Table 4.2. *Nearest Neighbor Matching Result for All Sample – REERV*

Number of observations:2.167 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv		
	Coefficient	Probability
n=1	-0.003 (0.001)	0.038**
n=3	-0.002 (0.001)	0.073***
n=5	-0.002 (0.001)	0.063***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.3. *Propensity Score Matching Result for All Sample – REERV*

Number of observations:2.167 Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on Reerv	-0.005 (0.001)	0.000*
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.4. Kernel Matching Result for All Sample – REERV

Number of observations:2.167 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv	Coefficient	Probability
Kernel: epan	-0.002 (0.002)	0.240
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

4.3. Results for Emerging and Developing Economies- Real Exchange Rate Volatility

Table 4.5 suggests that countries with higher economic development, financial development are more likely to implement inflation targeting in the emerging sample. The strong current account position creates a negative influence on stable on the exchange rate. The economic growth rate is inversely correlated adoption of inflation targeting framework. In countries that more integrated globally become more vulnerable to external shocks. Foreign reserves are not relevant to choose an inflation targeting regime. However, the inclusion of an insignificant coefficient variable in the regression does not prevent the balancing hypothesis.

Table 4.5. Probit Score Result for Emerging Economies- REERV

Emerging Economies		
	Coef.	Prob
Cab	0.029 (0.006)	0.000***
Gdpcg	0.424 (0.038)	0.000***
Bnks	0.005 (0.001)	0.000***
Rim	0.009 (0.009)	0.284
Gdpg	-0.420 (0.039)	0.000***
Topn	-0.009 (0.001)	0.000***
Cons	0.089 (0.158)	0.574
Number of observations	1446	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

From Figure 4.2, we obtain results in balancing conditions. The blue and red colors refer to non-inflation targeters, inflation targeters, respectively. Common support visual graph is related to countries to have a similar distribution.

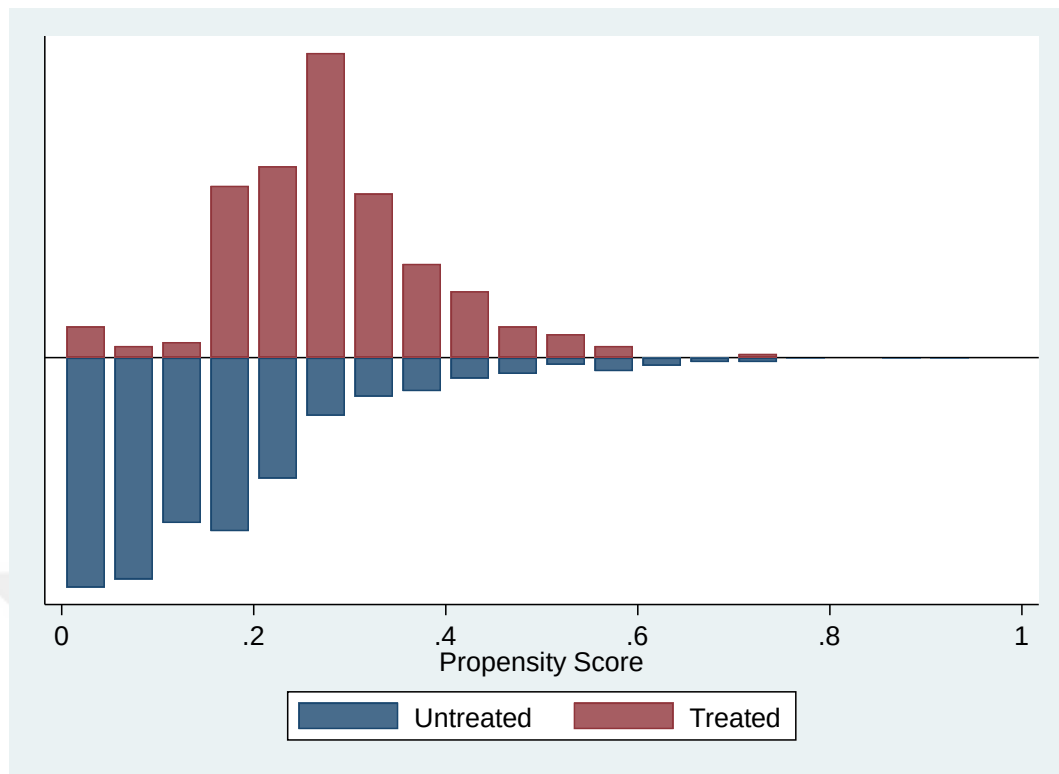


Figure 4.2. *Common Support for Emerging and Developing Economies – REERV*

Table 4.6, 4.7, and 4.8 illustrate the estimates average treatment effects on the treated using three matching results. Table 4.6 shows the results from three nearest-neighbor matching estimators with $n=1$, $n=3$, and $n=5$. Table 4.7 reveals results from propensity score matching. Table 4.8 summarize Epanechnikov Kernel-matching results. This regime does not outperform with $n=1$ and Kernel matching estimators. Considering the resulting effect on average exchange rate volatility is significant in $n=3$, $n=5$, and propensity score matching. The average exchange rate volatility significantly decreases to 0.004 percentage points. In other words, if non-inflation targeting countries had adopted inflation targeting, their exchange rate volatility would have decreased by 0.004. The conclusion of the analysis suggests that the estimated average treatment effect on exchange rate fluctuations statistically significant on inflation targeting countries in order to make resilient any shock. On the other hand, if non-inflation targeting countries had adopted inflation targeting, their fluctuations exchange rate would have been on average 0.004 percent lower.

Table 4.6. *Nearest Neighbor Matching Result for Emerging and Developing Economies-Real Effective Exchange Rate Volatility*

Number of observations:1.446		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv		
	Coefficient	Probability
n=1	-0.004 (0.002)	0.151
n=3	-0.004 (0.002)	0.066***
n=5	-0.004 (0.002)	0.046**
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.7 *Propensity Score Matching Result for Emerging and Developing Economies-Real Effective Exchange Rate Volatility*

Number of observations:1.446		
Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on Reerv	-0.004 (0.002)	0.096***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.8 *Kernel Matching Result for Emerging and Developing Economies-Real Effective Exchange Rate Volatility*

Number of observations:1.446		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv	Coefficient	Probability
Kernel: epan	-0.003 (0.003)	0.295
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Although inflation targeting regimes require more flexible regimes, in developing and emerging economies might lead to stable real effective exchange rate volatility, mainly because of relative stability in domestic prices. One reason is that inflation targeters focus on domestic considerations and respond to shocks. The second reason is that these countries take nontradable prices (Ouyang et al, 2016).

4.4. Results for Developed Economies- Real Exchange Rate Volatility

Table 4.9 demonstrate propensity score ratios according to the result of the probit estimation. In developed economies, countries' position about the current account is not essential to decide the transition inflation targeting framework. Poor economic development and low ratio trade openness can lead to higher likelihood adoption of inflation targeting framework. Countries with higher financial development, foreign reserves, and economic growth rates are more likelihood adoption of inflation targeting regime.

Table 4.9 *Probit Estimation Result for Developed Economies-REERV*

Developed Economies		
	Coef.	Prob
Cab	-0.015 (0.010)	0.136
Gdpcg	-0.210 (0.071)	0.003***
Bnks	0.005 (0.001)	0.000***
Rim	0.089 (0.016)	0.000***
Gdpg	0.275 (0.067)	0.000***
Topn	-0.006 (0.011)	0.000***
Cons	-1.116 (0.175)	0.000***
Number of observations	732	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Figure 4.3 shows the densities of countries implemented and not implemented an inflation targeting regime. The overlap of the blue and red blocks indicates that the common support is achieved.

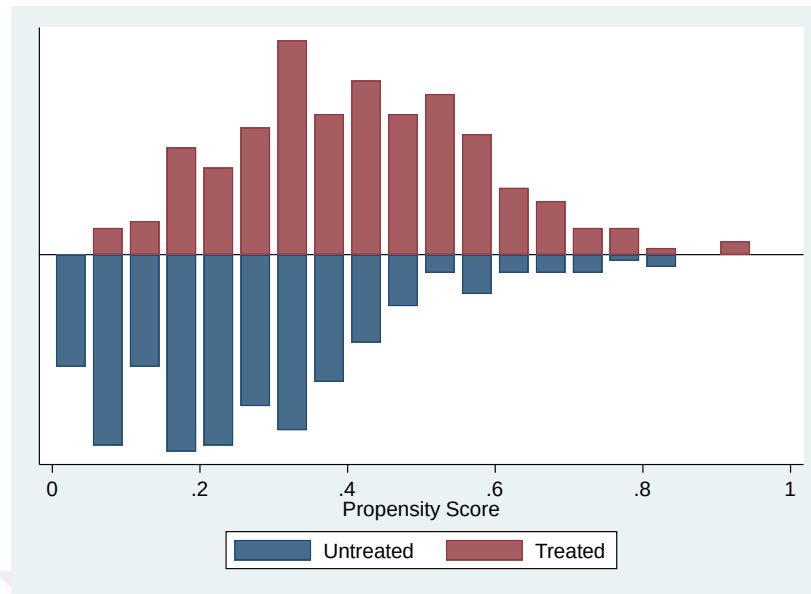


Figure 4.3. *Common Support for Developed Economies – REERV*

Table 4.10, 4.11 and 4.12 indicate treatment results in calculating different matching techniques. Table 4.10 provides the treatment impact of inflation targeting on real exchange rate volatility with $n=1$, $n=3$, $n=5$. While the results reveal 0.001 percentage increase significantly with $n=1$ and $n=5$ for the fluctuations, $n=3$ estimation results do not offer a significant effect. Kernel matching estimate suggests similar results with $n=3$ estimation regarding the impact of treatment on the stable exchange rate.

Table 4.10. *Nearest Neighbor Matching Result for Developed Economies-REERV*

Number of observations:721		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv		
	Coefficient	Probability
$n=1$	0.001 (2.909)	0.038**
$n=3$	0.000 (0.170)	0.186*
$n=5$	0.001 (1.700)	0.099***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.11. Propensity Score Matching Result for Developed Economies-REERV

Number of observations:721 Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on Reerv	0.005 (0.382)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.12. Kernel Matching Result for Developed Economies-REERV

Number of observations:560 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on FDI	Coefficient	Probability
Kernel: epan	0.000 (0.000)	0.907
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

4.5. Results for High Income Economies- Real Exchange Rate Volatility

The result of the probit regression analysis shows that the sound financial system, economic development level, more foreign reserves have a positive sign to select the inflation targeting regime. Increasing the economic growth rate, a higher ratio of trade openness can lead to a more unstable exchange rate. The current account position is not relevant to adopt an inflation targeting regime. However, since we desire economies targeting inflation to have similar features with those non-inflation targeters, we include this variable.

Table 4.13. *Propensity Score Result for Upper-Middle-Income Economies-REERV*

High Income		
	Coef.	Prob
Cab	-0.033 (0.009)	0.727
Gdpcg	0.043 (0.017)	0.000***
Bnks	0.003 (0.001)	0.000***
Rim	0.140 (0.020)	0.000***
Gdpg	-0.068 (0.026)	0.024**
Topn	-0.001 (0.001)	0.000
Cons	-1.267 (0.217)	0.000
Number of observations	1.066	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

While blue blocks demonstrate non-inflation targeting countries, red blocks show that inflation targeters. The figure in 4.4, we obtain a result that the propensity scores of targeting and non-targeting countries converge; thereby common support is provided.

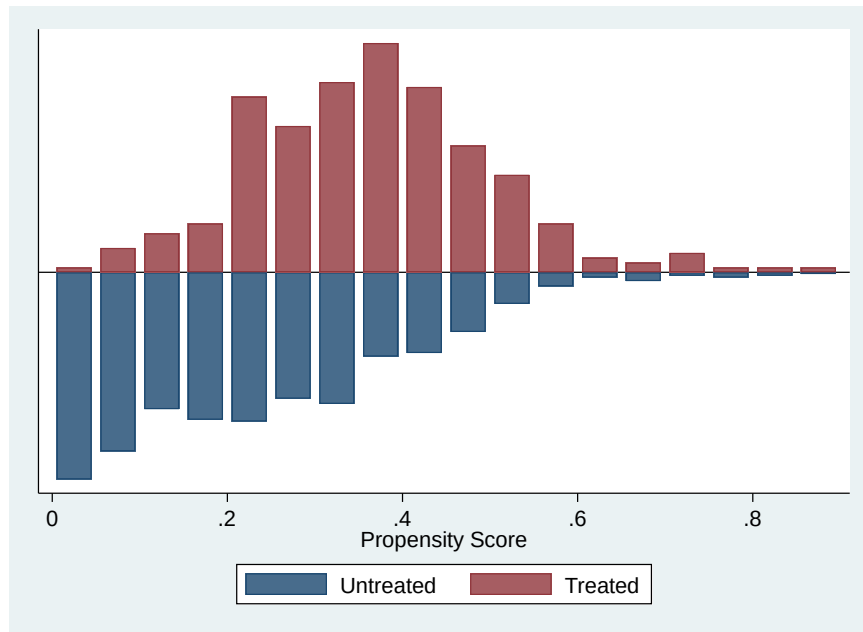


Figure 4.4. *Common Support for High Income - Real Exchange Rate Volatility*

Table 4.14, 4.15 and 4.16 summarize matching results with using nearest-neighbor, propensity score, kernel matching in high-income economies. In the inflation targeting countries have a positive and significant effect after adoption the regime. Whatever using matching technique gives a similar result, on average, the implementation of inflation targeting affects a rising in the rate of exchange rate volatility by 0.005. Put it another way, if non-inflation targeting countries had adopted inflation targeting, their inflation rate would have been 0.005 percent higher.

As high economies are mostly developed economies, real exchange rate volatility is positive. The higher external price component of real effective exchange rate volatility since more effective in inflation targeting developing countries allow them to behave more like floating exchange rate regimes.

Table 4.14. Nearest Neighbor Matching for High Income- REERV

Number of observations:883		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv		
	Coefficient	Probability
n=1	0.005 (2.909)	0.000***
n=3	0.005 (0.001)	0.000***
n=5	0.005 (0.001)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.15. Propensity Score Matching for High Income- REERV

Number of observations:883		
Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on Reerv	0.005 (0.001))	0.010***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 4.16. Kernel Matching for High Income- REERV

Number of observations:883		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on Reerv	Coefficient	Probability
Kernel: epan	0.005 (0.001)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

CHAPTER 5

5. ANALYZING THE EFFECTS OF INFLATION TARGETING ON FOREIGN DIRECT INVESTMENT

Due to globalization, international capital flows, which are portfolio investments and direct investments, become one of the factors affecting the world economies. Recently, foreign direct investment movement (FDI) spillover from advanced economies to emerging and developing economies. The common wisdom is that pull(external) and push(domestic) conditions affect the inflows of FDI. While push factors indicate the opportunity cost in investing in host countries such as foreign interest rates and world inflation rate, pull factors represent the macroeconomic situation, strong institutions, political stability (Valli and Masih,2014, p.10). It is crucial to understand what attracts FDI to a country to highlight linkages between foreign direct investment inflow and inflation targeting regime. Analyzing literature, inflation targeting regime impacts on FDI related to the pull factors in that inflation targeting regime affects the domestic macroeconomic conditions. With the adoption of an inflation targeting regime, central banks have higher credibility. Increased credibility of central banks leads to access to monetary policy intentions correctly to financial markets and the private sector. Thus, financial markets and the private sector take to plan investment decisions through a transparent and predictable framework. Decreased policy uncertainty causes lower transaction and information costs. Since the rate of return and the expectation of efficiency increase, foreign investors get to provide long term decision easily. A stable policy environment with an inflation targeting regime may lead to an incentive for developing countries, as FDI is closely related to long-term investment decisions (Tapsoba, 2012).

5.1. Variables for Foreign Direct Investment

Empirical literature finds that inflation targeting adoption helps decreasing trend in inflation rate, interest rates level, and exchange rate pass-through. By enhancing these key macroeconomic factors has shifted to more inflows FDI to developing countries. Although there is vast literature regarding FDI impact on macroeconomic variables and determinants of FDI to emerging and developing economies, the relationship between

FDI and inflation targeting not much researched. Firstly, the estimation of probit propensity score employs to reveal the relationship between these variables, examining the effect of inflation targeters help the higher inflow of FDI to developing and emerging economies.

$$Pr(iters = 1) = f(loggdpc, bnks, energyuse, gdpg, logpops, unemp) \quad (5.1)$$

In the 5.1 equation, “iters” refers to a dummy indicator. If a country adopt inflation targeting, the regression value takes “1” and “0” otherwise. The right side of the function in the above equation refers to control variables that increase the likelihood of transition to the inflation targeting regime and determines more attracting FDI. Control variables are the real GDP per capita (loggdpc), domestic credit to the private sector by banks of GDP (bnks), energy consumption (energyuse), economic growth rate (gdpg), population size (logpops), and unemployment rate (unemp).

Control variables refer to the covariates matrix preferred for the PSM model. These variables;

- Refers to the characteristic features of the countries.
- It provides an arbitrary process regarding the choice of switching inflation targeting.
- They are related statistically to the consequences of inflation and inflation volatility.

Log of Real GDP Per Capita (loggdpc): This variable shows a return on investment. Since the capital market does not have well-functioning where emerging and developing economies, the return on capital is low. Therefore, there is a negative linkage between FDI/GDP and higher per capita income (Asiedu, 2002).

Energy consumption (energyuse): This variable is kg of oil equivalent per capita from the World Bank. Energy consumption in the host economy is a developed infrastructure indicator that availability is crucial for foreign investors. Since good infrastructure leads to higher productivity for investment, there is a positive relationship between energy use and FDI. Infrastructure availability is crucial for foreign investors.

Domestic credit to private sector by banks share of GDP (bnks): This variable shows financial depth. Financial development offers well-functioning institutions that contribute to investment and economic growth. It is directly related to the transformation of savings into investments in an economy. A foreign investor invests in getting a higher

marginal return of capital. Also, the increase in the development of the financial system in the host country makes it possible for foreign investors to access more external finance. It causes the investment levels desired by the companies to provide internal cash flow (Desbordes and Wei, 2017). Probit regression result reveals that closely related relationships in examining literature. The level of financial development leads to positive influence to choose inflation targeting regime and ratio of FDI inflow in both country groups.

The growth rate of GDP: This variable represents the market size in the recipient economy, which is an essential determinant of more attractiveness for FDI inflows. A higher economic growth rate indicates large and expanding markets as FDI is long term investments, the expectation of growth in the market where the host country is directly proportional to the expected profitability of the investment. Therefore, with a larger market size, firms can expect higher profit from their investments.

Population size: Population size is related to labor endowments. Large population size represents in the host economy a large labor force, an extensive skill base since the availability of an abundance of unskilled workers offers a large market for investing in labor-seeking multinational enterprises. As an expected economic relationship, higher population size has a strong and significant effect on driven FDI inflow to emerging and upper middle-income economies.

Unemployment rate (unemp): This variable is the total labor force as a share of total population. The higher unemployment rate is linkaged with levels of skill and training.

5.2. Results for Emerging Economies Foreign Direct Investment

The result of probit estimation shows that with higher electricity usage shifts movement more capital inflow to developing and emerging economies. The inclusion of the unemployment rate is positively related to the more attractive inflow of FDI. The level of financial development leads to positive influence to choose inflation targeting regime and increasing movement of FDI emerging and developing economies. As an expected economic relationship, higher population size has a strong and significant effect on driven FDI inflow to emerging economies. In examining the regression result, suggest that the determination of FDI inflow and likelihood adoption of inflation targeting regime are not

relevant economic growth. However, we desire to match countries that are similar in terms of their features. Therefore, we include the variable in the regression.

Table 5.1. *Probit Estimation for Emerging and Developing Economies- FDI*

Emerging and Developing Economies		
	Coefficient	Prob
loggdp	-0.219 (0.060)	0.000***
gdpg	0.000 (0.013)	0.962
energyuse	0.007 (0.042)	0.000***
unemp	0.042 (0.007)	0.000***
logpops	0.587 (0.008)	0.000***
bnks	0.008 (0.001)	0.000***
cons	-3.484	0.000***
Number of observations	1.193	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

After probit regression analysis, we estimate a common support graph, which is one of the assumptions of propensity score matching conditions to decide balancing hypotheses. Figure 5.1 indicates that emerging and developing economies overlap visually by the graphic. The result of the figure reveals overlapping conditions that decide matching analysis between observable and unobservable features.

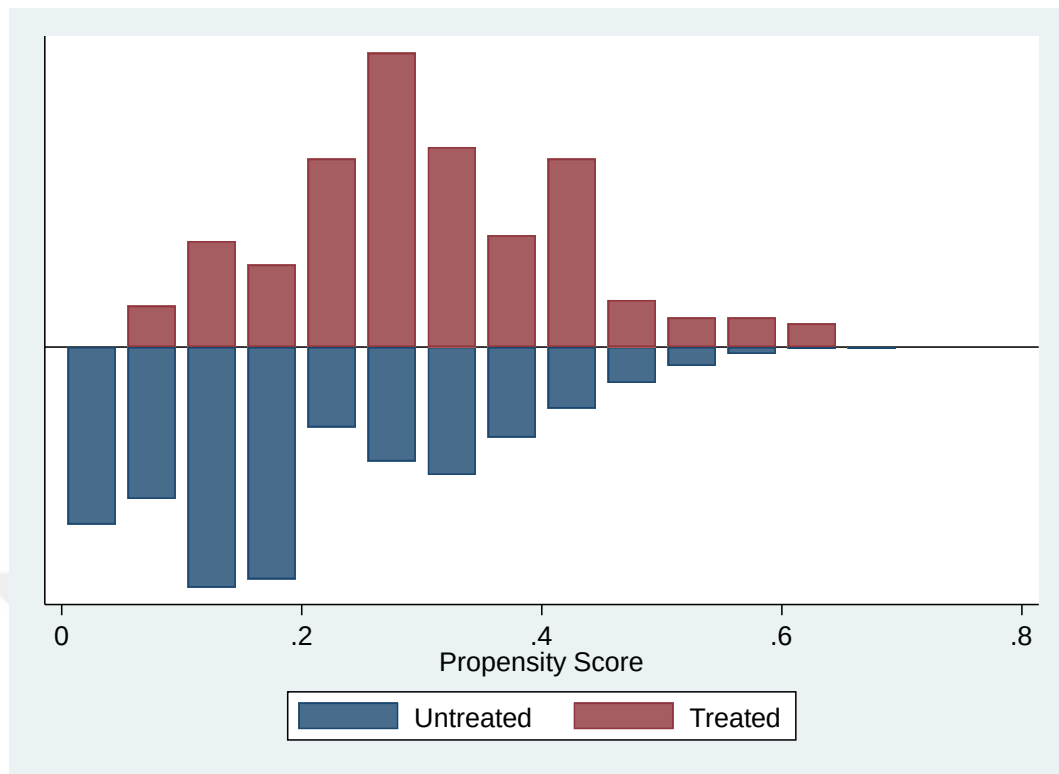


Figure 5.1. *Common Support for Emerging and Developing Economies- FDI*

Table 5.2, 5.3, and 5.4 illustrate the estimates average treatment effects on the treated using three matching results. Table 5.2 shows the results from three nearest-neighbor matching estimators with $n=1$, $n=3$, and $n=5$. Table 5.3 reveals results from propensity score matching. Table 5.4 summarize Epanechnikov Kernel-matching results. Whatever using the matching technique, results are strong and robust. The impact on the increased inflow of FDI implementing inflation targeting framework is on average 1.32 percentage. In other words, if non-inflation targeting countries had adopted inflation targeting their inflow of FDI would have increased by 1.32 percentage.

Table 5.2. Nearest Neighbor Matching Result for Emerging and Developing Economies-FDI

Number of observations:1.799 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on FDI		
	Coefficient	Probability
n=1	1.326 (2.909)	0.000***
n=3	1.325 (0.170)	0.000***
n=5	1.316 (1.700)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 5.3. Propensity Score Matching Result for Emerging Economies-FDI

Number of observations:1.799 Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on FDI	1.469 (0.382)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 5.4. Kernel Matching Result for Emerging Economies- FDI.

Number of observations:560 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on FDI	Coefficient	Probability
Kernel: epan	1.537 (0.223)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

5.3. Results for Upper-Middle-Income Economies for Foreign Direct Investment

Table 5.5 presents the results of probit estimation for upper-middle-income economies. Higher electricity consumption in economies can lead to more capital inflow to upper-middle-income economies. The inclusion of the population size is positively related to more attract inflows of FDI. The level of economic development has a negative influence on choosing inflation targeting regime and increasing movement of FDI. As an expected economic relationship, a higher level of financial development has a strong and significant effect on driven FDI inflow to economies. In examining the regression result, suggest that the determination of FDI inflow and likelihood adoption of inflation targeting regime are not relevant economic growth. However, we desire to match countries that are similar in terms of their features. Therefore, we include the variable in the regression

Table 5.5. *Probit Estimation for Upper-Middle-Income Economies- FDI*

Upper Middle Income		
	Coefficient	Prob
loggdp	-0.381 (0.098)	0.000***
gdpg	-0.006 (0.016)	0.679
energyuse	0.009 (0.017)	0.000***
unemp	0.437 (0.009)	0.000***
logpops	1.133 (0.002)	0.000***
bnks	0.004 (0.002)	0.029**
cons	-4.971 (0.933)	0.000***
Number of observations	792	
Prob > χ^2	0.0000	
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

After estimating propensity scores, we obtain Figure 4.9 to decide on a common support condition. This demonstrates the densities of countries implemented and not

implemented an inflation targeting regime. The overlap of the blue and red blocks indicates that the common support is achieved.

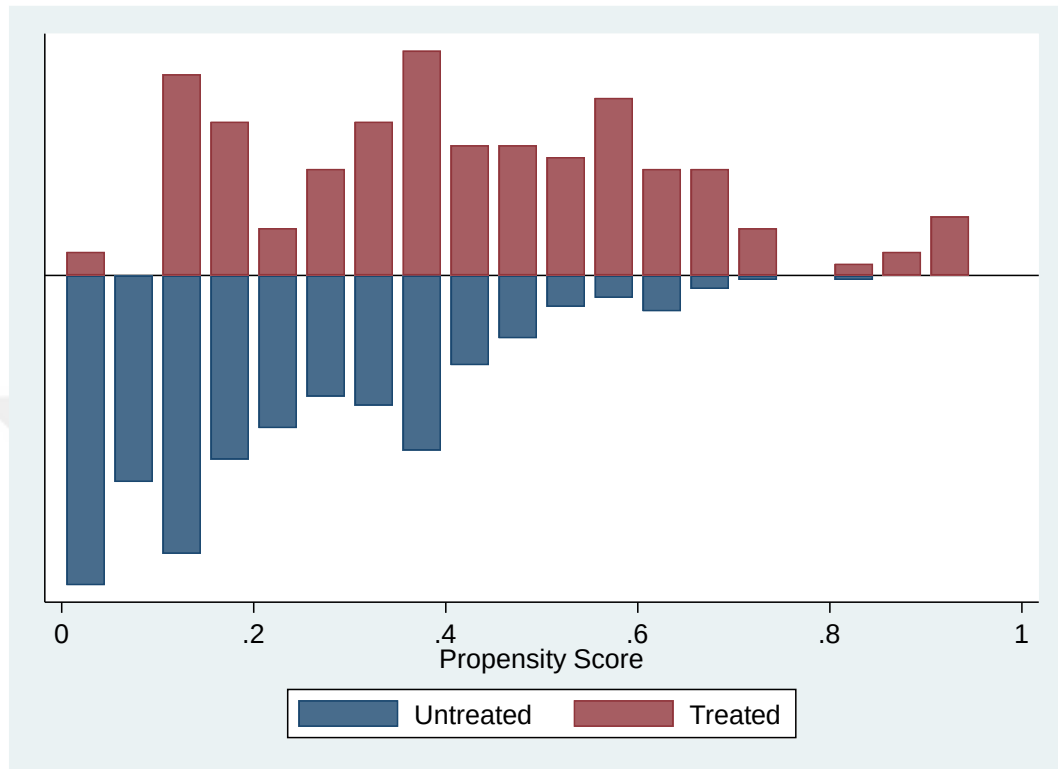


Figure 5.2. *Common Support for Upper-Middle Income Economies- FDI*

After completed steps that are estimated propensity scores and provided the common support between control and treatment groups, the last step is to address matching results.

From table 5.6, the result suggests that the implementation of inflation targeting regime seems to significantly more attract foreign direct investment. Among the three types of nearest neighbor matching $n=1$, $n=3$, $n=5$ offer more inflow of foreign direct investment inflow. Also, the findings support at table 5.7 and 5.8 movements of inflow of FDI is positively correlated with select inflation targeting regime using Kernel and PSM estimator. As a result, on average, the adoption of inflation targeting affects increasing in the rate of inflow of FDI by 1 percentage points. To be more precise, if non-inflation targeting countries had adopted inflation targeting, their inflow of foreign direct investment would have been 1 percent more.

Table 5.6. *Nearest Neighbor Matching Result for Upper-Middle Income Economies-FDI*

Number of observations:560		
Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on FDI		
	Coefficient	Probability
n=1	1.010 (0.252)	0.000***
n=3	1.051 (0.215)	0.000***
n=5	1.094 (0.204)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 5.7. *Propensity Score Matching Result for Upper-Middle Economies-FDI*

Number of observations:560		
Treatment Model: Logit		
ITers (inflation targeters vs non inflation targeters)	Coefficient	Probability
ATE on FDI	1.210 (0.310)	0.000***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

Table 5.8. Kernel Matching Result for Upper-Middle Income Economies- FDI

Number of observations:560 Distance Metric: Mahalanobis		
ITers (inflation targeters vs non-inflation targeters)		
ATE on FDI	Coefficient	Probability
Kernel: epan	0.866	0.001***
Note: Robust standard errors are reported in parentheses. *, ** and *** indicate the significant level of 10 %, 5% and 1%, respectively.		

The higher inflow of FDI is of tremendous importance for emerging and developing countries and upper-middle income economies since FDI contributes to developing transition economies with insufficient savings. By transferring know-how and technology from foreign investors also cause increasing productivity in the domestic economies by creating employment. Outward-oriented development strategy also create enhancing international competitiveness (Ernst, 2005)

CONCLUSION

The number of countries that switched to the inflation targeting framework has gradually increased since the first time it was implemented in 1990. Inflation targeting has been marked as the most popular and long-lived monetary framework during the post-Bretton-Woods era. Countries that have started implementing the inflation targeting regime carry out a series of structural policy reforms after transitioning to the regime. Besides, those economies achieve significant improvements in their fiscal policies.

A nominal anchor has been sought for a suitable monetary policy to ensure price stability since the '70s. Historically, the exchange rate and monetary aggregates were preferred through the intermediate targets to achieve price stability. The weakness of the exchange rate-based stabilization programs to respond to crises and the resulting loss of exchange reserves for capital outflows caused severe damage to national economies. Monetary authorities searched for a new nominal anchor, and the ongoing financial developments caused more unpredictability for the relationship between monetary aggregates and price stability. The inflation targeting policy emerged in New Zealand in 1990 as a result of these developments. Monetary authorities considered the problems and failures of previous policies such as reliability, central bank independence, and transparency while creating the inflation targeting policy.

Earlier empirical studies revealed that inflation targeting is a good monetary policy tool to control inflation. However, after the global crisis in 2008, inflation targeting has still been questioned about its success. One view argues that price stability is not sufficient alone to provide financial stability. Therefore, researchers claim that the regime of inflation targeting itself did not bring success. Inflation targeting is beneficial due to the Great Moderation era introduced by Stock and Watson (2002). The Great Moderation period is defined with low volatility of business cycle fluctuations all over the world. The question becomes whether the regime is still successful after controlling inflation around the globe.

This study utilizes the propensity score matching method, which is the best-fitted methodology for solving the self-selection problem to evaluate the counterfactual analysis of inflation targeting. The transition process of countries to inflation targeting is dependent on a historical process. Generally, after a crisis, economies start to implement an inflation targeting regime. On the other hand, the inflation targeting regime is much more than a monetary policy strategy. Countries must complete some institutional

competencies before adopting the regime. Because of all these reasons, the decision to switch to the regime is not random. In cases where the preference is not random, estimation results with linear econometric techniques lead to biased, overestimated results. The propensity score matching method is employed in this study to run the analyses while dealing with the self-selection bias. The study uses the propensity score matching framework and examines whether the performances for inflation and inflation volatility, real exchange rate volatility, and foreign direct investment inflow to reveal any substantial differences among the economies that implement inflation targeting, and those do not.

The analysis for the evaluation of the inflation targeting regime consists of three steps in the study. First, estimated propensity scores are calculated between each control and treatment of individuals through probit regression. Probit estimation results reveal similar characteristics of each country groups that are considered in the study. Calculated estimated propensity scores expose the relationship between variables and expectations. It follows, then, control variables must have the following properties: (i) targeting countries should be adopted only after some preconditions are met ; (ii) covariates are related statistically to the consequences of the outcome. Second, the necessary condition of matching techniques analyzes to control overlap between inflation targeters and non-inflation targeters. We run the visual analysis of density distribution through the estimated propensity score in treated and untreated units with the common support graph. The common support graph offers ideas regarding selected covariables, which satisfy the conditional independence assumption. The third step is to estimate the average treatment effect to assess the role of an inflation targeting regime. Three matching methods, namely, the nearest-neighbor matching, propensity score matching, and kernel matching methods are used to examine the average treatment effect of inflation targeting regime on inflation rate and inflation volatility, exchange rate stability, and foreign direct investment inflow.

The first aim is to examine the effect of inflation targeting regime on reducing the inflation rate and keep under controlled inflation. The effect of inflation targeting on reducing inflation rates may vary depending on the institutional characteristics of the economies and their subjective macroeconomic conditions. For this reason, the effect on inflation rates is documented in the whole sample at first. According to the matching results for the overall sample economies, the results reveal that inflation rates drop by an average of 10 percent. To be more precise, the analysis document that if non-inflation

targeting countries had adopted the inflation targeting regime, their inflation rate would have been 10 percent lower.

When we exclude the G7 economies, whose inflation rates are not very high and high credibility before the transition to the regime, the coefficient of the reduction in inflation percentages raises a little more. The euro area consists of a group of countries that do not implement inflation targeting. They implement a specific monetary policy that they adopt within. Excluding the countries whose institutional framework and internal dynamics are interdependent as a group, the impact of the fall in inflation rates varies by 1 percent. Second, focussing inflation volatility, not included G7 and Euro Area, the regime is more successful in accessing the inflation rate on average by 2.5. In other words, the results reveal that if non-inflation targeting countries had adopted an inflation targeting regime, their inflation rate would have decreased by 2.5 points.

Moreover, to better analyze the impact of the inflation targeting regime, the entire sample group is divided into the first group of developed and the second group of developing and emerging economies. The credibility of the central bank of the developed country groups, the previous inflation rates, and the degree of flexibility of the regime is very different from those of the developing country groups. The findings from developing and emerging economies matching results suggest that the inflation rate and its volatility remarkably decreases. Therefore, we can conclude that the elements of regime have outperformed in developing and emerging economies than that do not implement an inflation targeting framework by an average of 12 percentage. Applied matching estimation for developed economies presents that reducing the inflation rate and its volatility has no statistical difference between inflation targeters vs. non-inflation targeters. One reason is that central banks of developed economies that do not implement inflation targeting do so implicitly. The second is that developed inflation targeters already have robust macroeconomic foundations. The motivations for the transition to the regime are mostly aimed at a sustainable institutional framework. Since there is no institutional change in developed economies after the regime, change expectations are ineffective. While developing economies contain much heterogeneity, developed economies have a good macroeconomic indicator. Next, to make the results of the study more reliable, groups of OECD member economies, which are socioeconomically similar to each other, are examined. Compared to the reduction of the coefficient of the inflation rate and its volatility in developing economies, the OECD inflation targeter has a lower

effect among non-inflation targeters. However, the OECD inflation targeters help to reduce the inflation rate and its volatility by 5 percent on average compared to OECD non-targeters. To be more precise, if non-inflation targeting countries had adopted inflation targeting, their inflation rate and its volatility would have been 5 percent lower. As a result, the inflation targeting regime indicates a successful nominal anchor in an economy that is open to the global and free capital movements, especially for emerging and developing economies. The regime is considered as sustainable and feasible considering the success of the approach in cutting the fluctuations in inflation rates.

A central fear of developing economies is whether the inflation regime will remain insensitive to the external shocks because of the flexible exchange rate regimes. There is a probability that the fluctuation in exchange rates regarding the sustainability of the external balance will cause a sudden stop to capital movements. Matching results regarding the whole sample, inflation targeting has a small but significant effect on lowering fluctuations on the exchange rate. The findings are similar compared to the whole sample for developing and emerging economies. Assessment of developed economies on the exchange rate volatility impact of inflation targeting suggests that fluctuations are positive and significant. We utilize matching results for high-income economies with similar characteristics of the developed economies to get robust results and obtain similar findings. While developing inflation targeting regimes should be associated with the more stable effective exchange rate, and mainly due to relative stability in internal prices, developed economies are primarily driven by the relative price of tradables.

The adoption of inflation targeting increases the resistance of economies against various speculative attacks. Central banks provide an economic environment with less uncertainty. We expect foreign direct investments to have a positive impact since it includes long-term decisions. While analyzing the effect of the inflation targeting regime on foreign direct investments, we analyze the sample groups that are consisted of developing and the upper-middle income economies. The reason for choosing there two sample groups for comparison is that the liberalization movements observed since the 1980s are in the direction of transferring resources to developing countries. Second, it causes capital accumulation without increasing the external debt burden on the path to growth and development for economies. Therefore, developing and emerging economies also change their policies to attract foreign direct investment. Third, in developing and

emerging economies, there is a lack of effective inflation rates. There is no theoretical causality relationship between the regime and the inflow of FDI, as it does not differ much in institutional terms. For this reason, we analyze the regime's driving force on foreign investments across groups of developing and emerging economies as well as the upper-middle income economies. The group of developing and emerging economies differs much more in terms of political risk and fiscal dominance. Since the middle-income economies have similar characteristics in terms of fiscal and unemployment situation, we desire to examine the results of the study to be reinforced within this sample. In both country groups, the regime in attracting foreign direct investment occurs. The results document that the effect is significant and positive with a magnitude of 1.50 percentage. Besides, the sample for developing and emerging economies, the results reveal a significant and positive coefficient of around 1 percent on average in the upper-middle-income country group. To put another way, the analyze indicates that if non-inflation targeting countries had adopted inflation targeting, their inflow of FDI would have increased by 1.50 percentage for the group of developing and emerging economies, and 1.00 percentage for upper-middle income economies.

After examining the performance of countries under the inflation targeting regime using various matching techniques, the findings document that inflation targeters are performing better on the examined economic conditions compared to those non-inflation targeters to reach better macroeconomic conditions. When the sub-samples are examined, it is striking that the preconditions provided by the countries to adopt the inflation targeting regime have a powerful effect on the success of the regime. Except for the group of developed countries, inflation targeting has a convincing success in reducing and controlling inflation rates. Because of the inflation targeting regime, the group of developing and emerging economies have much more inflow on foreign direct investments, which is a high amount of foreign capital. Besides, the results on real effective exchange rates suggest that inflation targeting does not create an adverse condition for countries against external shocks.

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